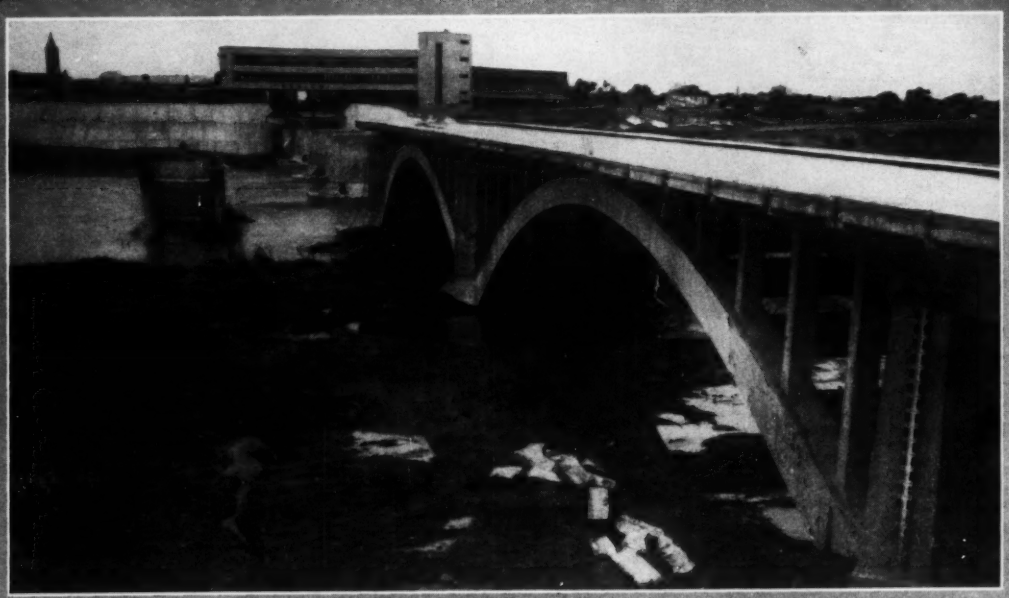
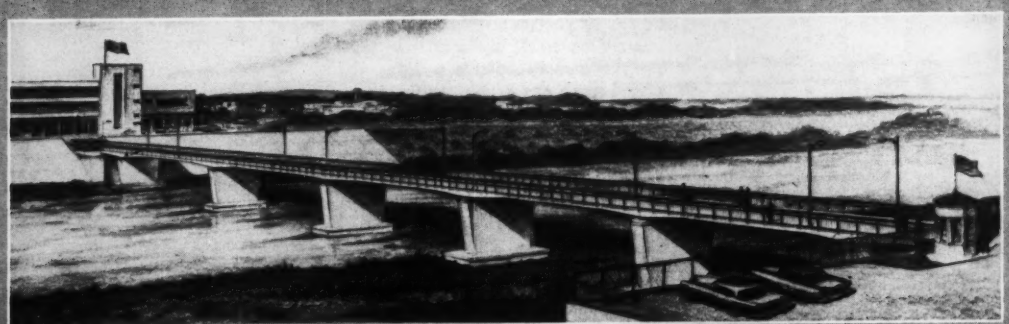
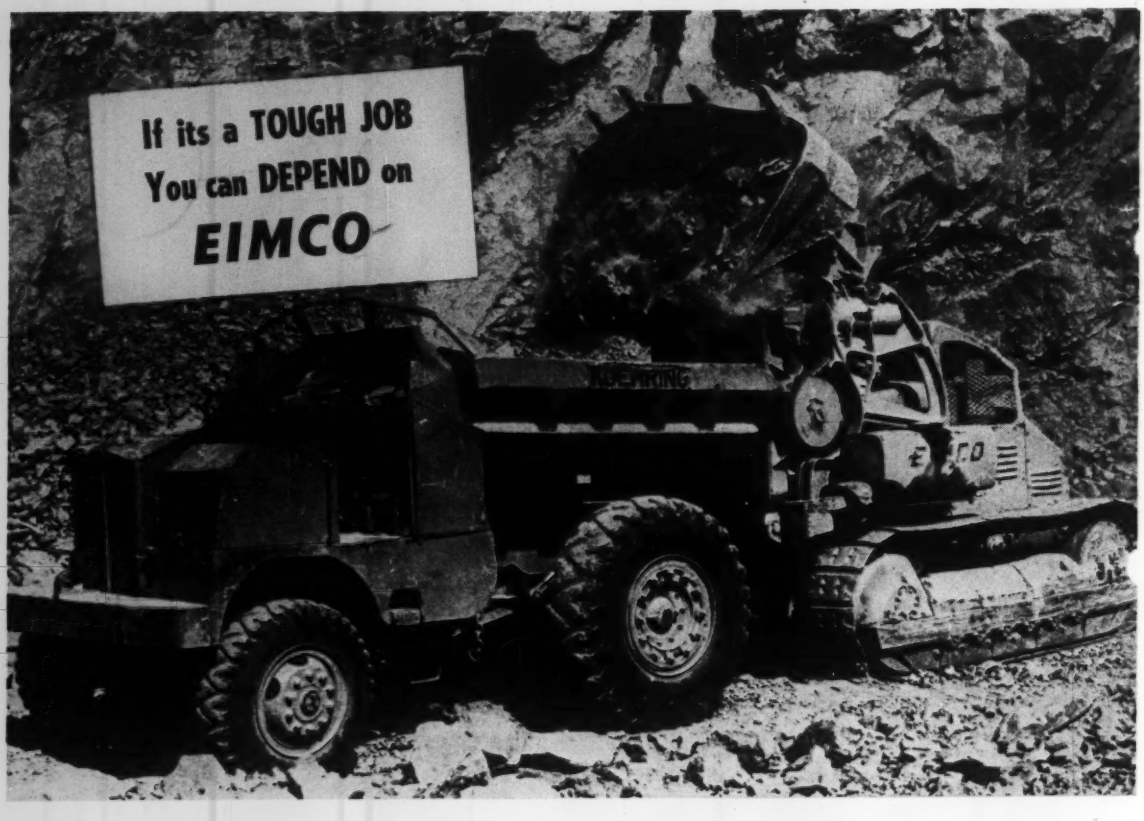
CIVIL ENGINEERING





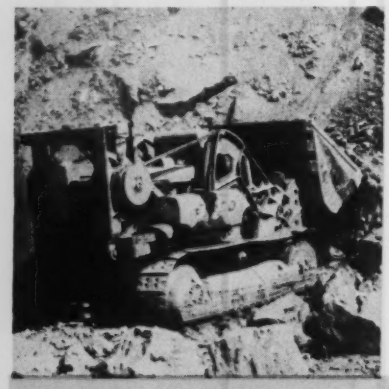
FLOOD-WRECKED BRIDGE OVER RIO GRANDE REBUILT IN PRESTRESSED CONCRETE • ARTICLE BY KOEBEL AND SONESSON



Hard, Rough, Tough Jobs Need Eimco Dependability

This case study concerns one Eimco 105 loader on which an open pit mine depends for its entire production.

Location — in an isolated and remote area of Southwest Africa.



Conditions — dusty, dry and hot.
Pit floor uneven-solid rock.
Mining — selective
Operators — native
Maintenance — Nil

Report — The Eimco 105 Tractor Excavator has operated some 3200 hours on consecutive two shift basis under the most difficult conditions. Native operators are unnecessarily abusive of the equipment. The ore is exceptionally abrasive and heavy. No other loading equipment is available so the Eimco must stay on the job. One operator ran the 105 a complete shift without fan belts, both of them run the machine to the solid rock wall and spin the tracks when cleaning out an ore pocket.

Eimco does not recommend abuse on their tractor-excavators or any other equipment but Eimco produces a machine that can stay on the job day in and day out—month in and month out—when you are depending on it and when plant capacity depends on a single production loading unit.

There are many reasons for Eimco superiority on the tough jobs. The design of an Eimco is simple-strong. The material of construction is all alloy steel. The operating features make it the easiest tractor to operate and the most maneuverable. When you need guts in a tractor, compare an Eimco with anything you are using or have used previously.

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B-173

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FAIRCHILD ENGINE DIVISION installed more than 23,000 feet of Vitrified Clay Pipe sewers and drains recently to serve the company's new $5 million plant at Deer Park, N.Y. The lines will carry many types of industrial wastes, including hard-to-handle process drainings from machines in the plant.

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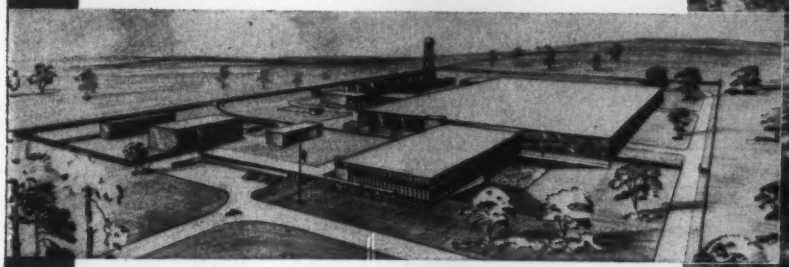
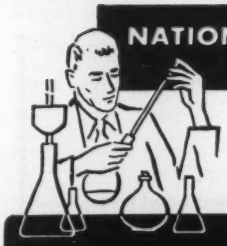


DESIGNED AND CONSTRUCTED by the Austin Company. Job Superintendent: Walter Michaelson

Vitrified CLAY PIPE

CLAY PIPE NEVER WEARS OUT!



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C-1055-1

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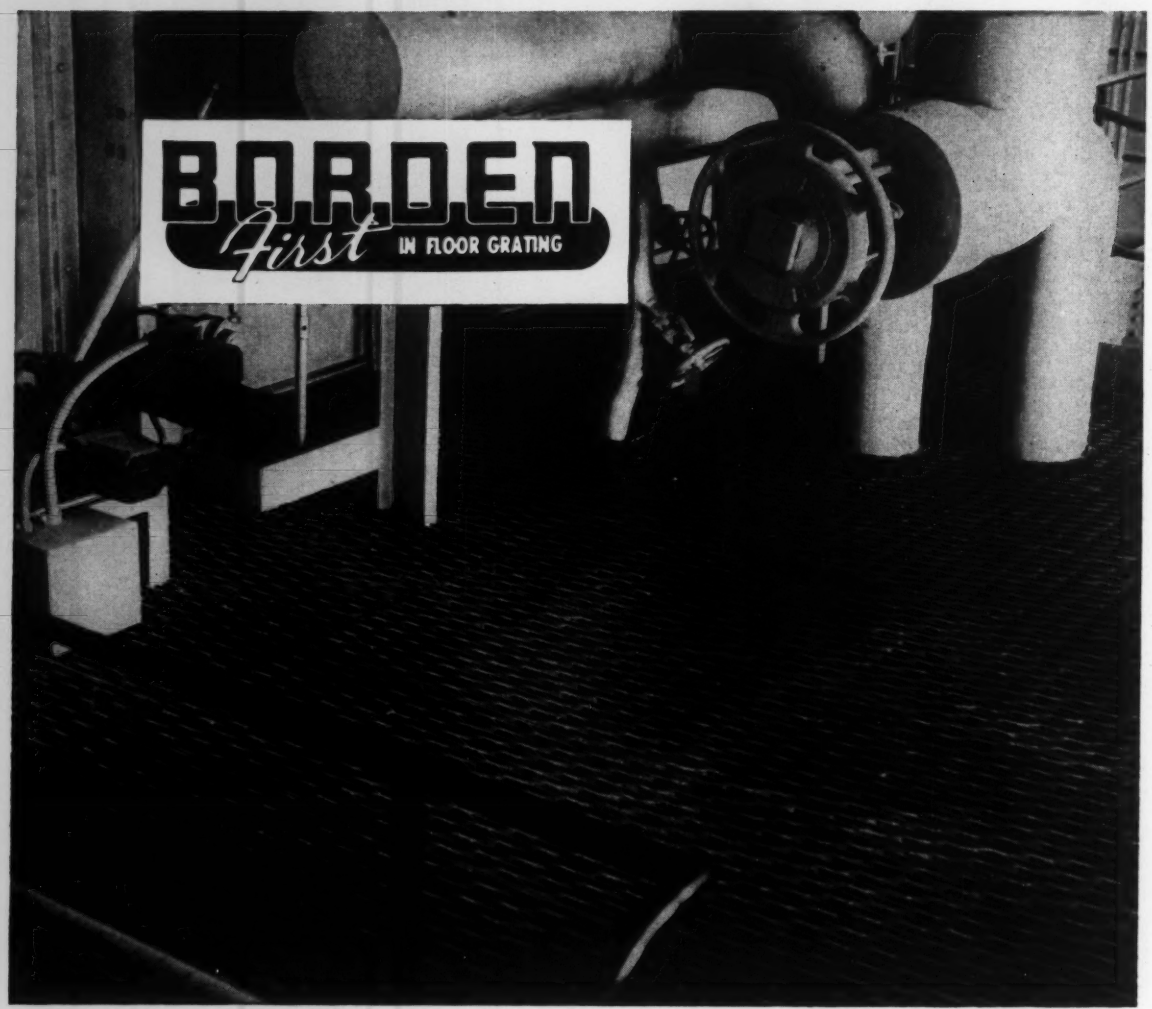

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MARCH 1956
VOL. 26 • NO. 3

THE MAGAZINE OF ENGINEERED CONSTRUCTION

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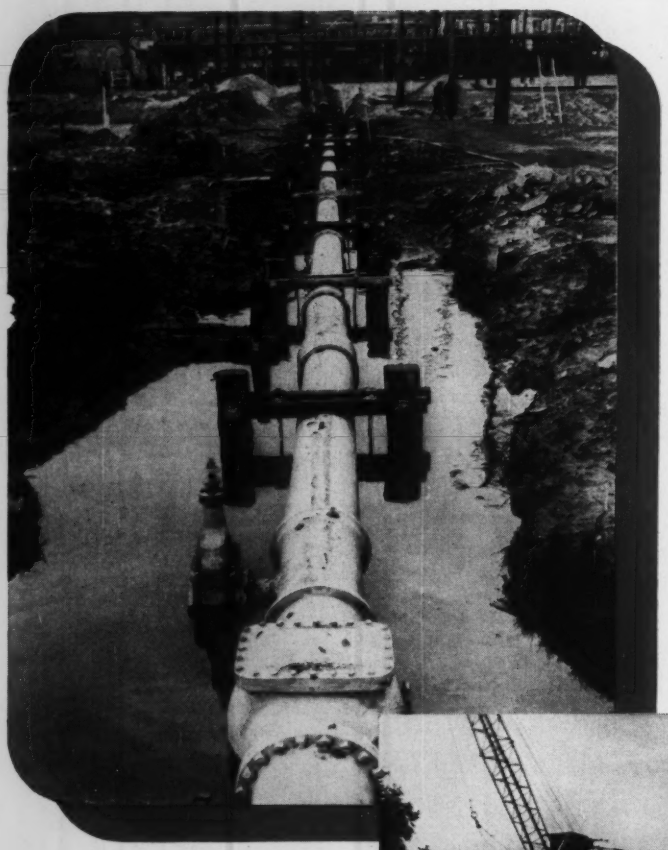

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Nearly two miles of 6" to 20" cast iron pipe for potable, process, and fire protection water systems and sewer system for petrochemical plant in Tuscola, Illinois.

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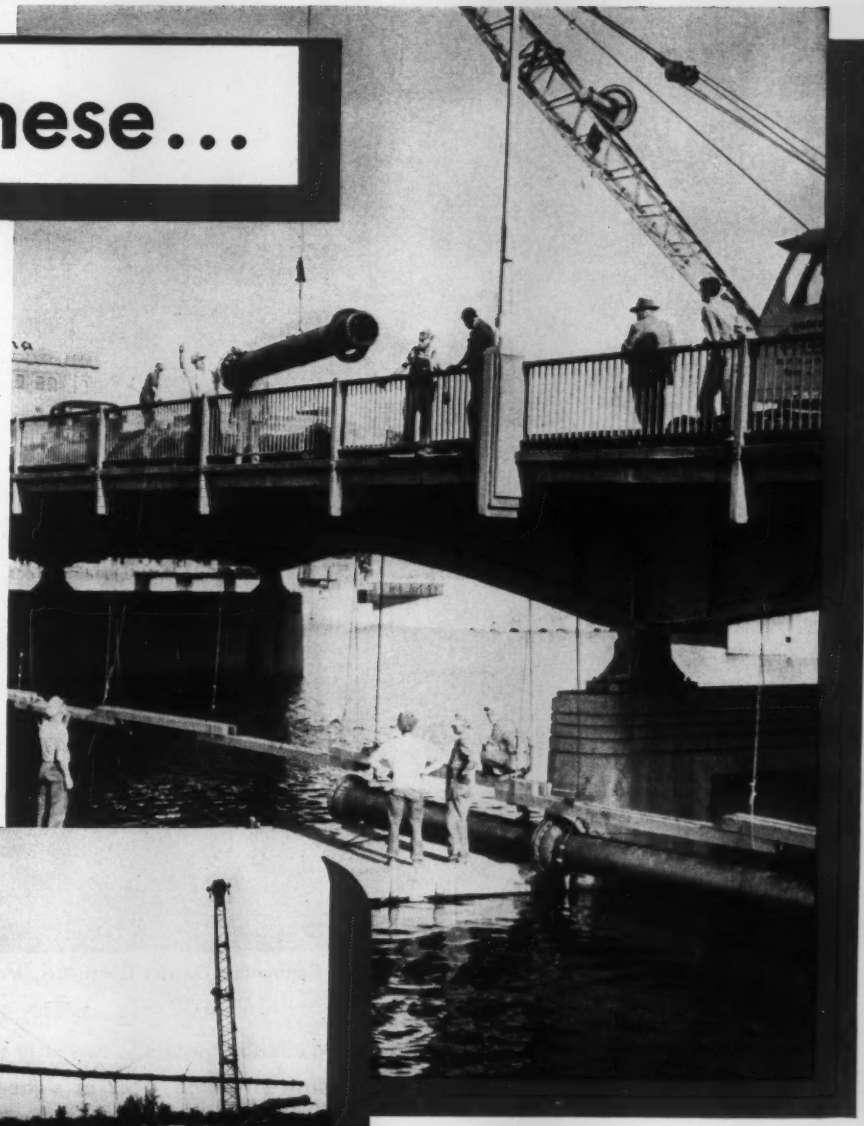

Flexible Joint cast iron pipe being laid across 600 feet-wide river at Waterloo, Iowa, for feeder line operating under 85 psi water pressure.

Installing 24-inch Flexible Joint cast iron pipe for river crossing at Fort Lauderdale, Florida.

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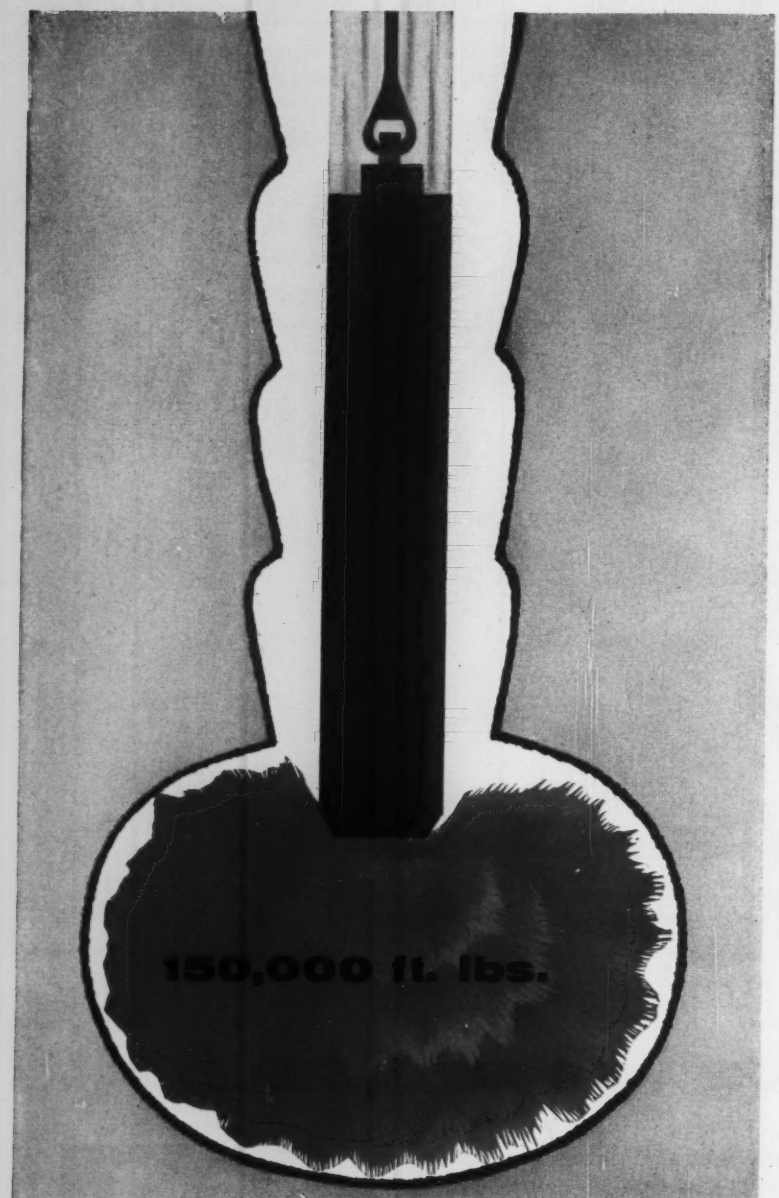

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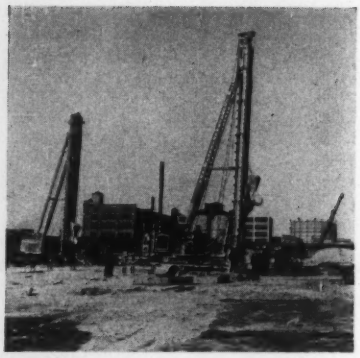

FRANKI FACTS

When a new plant for Colonial Provision Company of Boston was planned, the foundation originally specified was cast-in-place concrete piles. After a study of the Franki system, the owner, Rabson Realty Corporation, approved the use of Frank Displacement Caissons in lieu of cast-in-place piles and thus a substantial saving in cost to the owner was achieved.

A total of 309 displacement caissons were forged into the ground with 150,000 foot-pound blows. Each caisson, with its expanded base, had a nominal shaft diameter of 22 inches. The caissons which varied in length from 13 to 64 feet, were driven into soil consisting of peat, clay or silt underlaid by sand at depths from 10 to 100 feet below the surface.

Under a 240-ton test load (twice the design load of 120 tons) one of these displacement caissons showed a net settlement of only $1/4$ inch.

In addition to these caissons, 54 pipe piles were driven to depths from 53 to 103 feet.

The results—**Saving in cost—Approximately $50,000.**

The architects & engineers were Henschien, Everds & Crombie, of Chicago. Thompson & Lichtner of Boston was the inspection engineer.

LITERATURE AVAILABLE

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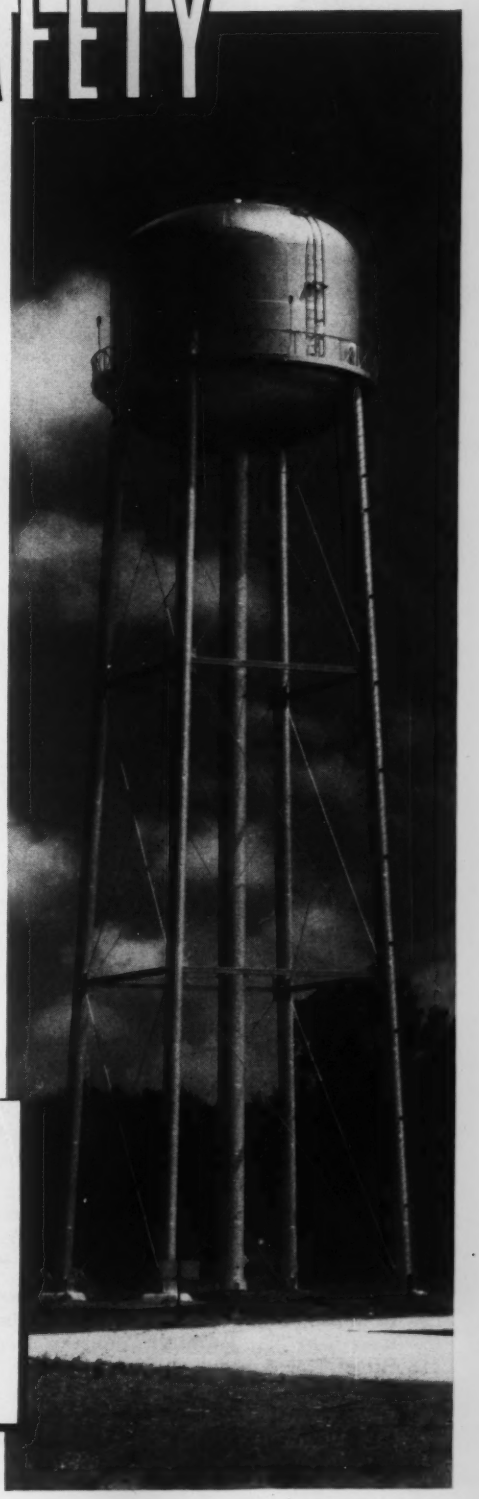

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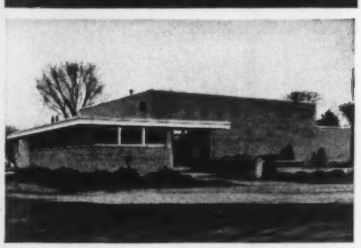

A 51% increase in population caused East Aurora, N. Y. to expand and modernize its water works. Wooden structure (above) was replaced by a modern brick building which contains the latest in water conditioning equipment.

Allis-Chalmers Scraper and Tractor Fleet Moves Four and a half Million Cubic Yards

Four HD-16 tractors with 20-cu. yd. Allis-Chalmers scrapers level a hill to make a large fill. Torque converter drive helps units return uphill fast for next load . . . cut valuable time from every cycle.

Never an idle moment for Allis-Chalmers tractors—when not push-loading they are busy dozing. An HD-21, right rear, compacts earth with a sheeps'-foot roller.

Motor Scrapers and HD-21's and HD-16's with pull-type scrapers level steep grades on Millbrae project near San Francisco

In leveling 50 acres of rugged California hills to complete its Millbrae housing project just south of San Francisco, Trousdale Construction Co. is moving 4½ million cubic yards of earth—with over a million cubic yards to be placed on a single fill.

To handle the job, Trousdale called on Tecon Construction Co. of Dallas, Texas. Tecon called on its fleet of Allis-Chalmers torque converter drive crawler tractors—six HD-21's and six HD-16's. In addition, Tecon brought in a fleet of Allis-Chalmers pull-type and motor scrapers to do the dirt hauling.

On this big project, the HD-21's and HD-16's are overcoming steep grades and stubborn hills. One reason: torque converter drive which makes full use of maximum engine horsepower . . . automatically matches tractor speed and pull to load and terrain conditions . . . provides outstanding operating ease . . . eliminates engine stalling and most shifting, reduces shock and strains to power train.

Other reasons: Allis-Chalmers diesel engine design causes exploding fuel to exert follow-through push on the pistons . . . provides maximum leverage when crankshaft is at most favorable angle . . . eliminates combustion knock, gives complete, clean combustion and more usable power per drop of fuel.

As the going gets tougher on this job, other HD-21 and HD-16 advanced design features show their superiority: all-steel box-A main frame, 1,000-hr lubrication, straddle-mounted final drives, Tru-Dimension machined and hardened track—all help these big tractors deliver the goods in output, dependability and service simplicity. Let your Allis-Chalmers dealer prove it!

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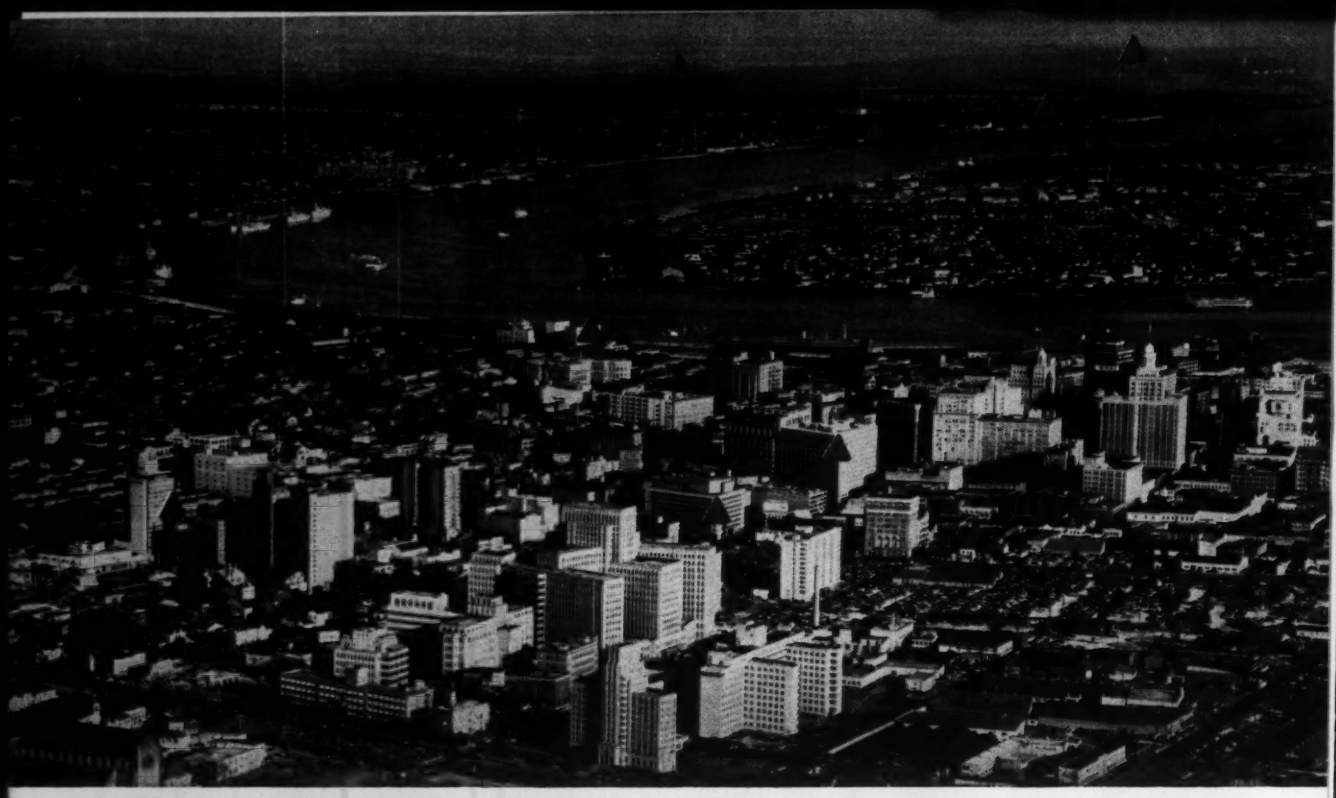

THE RED TRIANGLES INDICATE STRUCTURES BUILT ON RAYMOND FOUNDATIONS

Photo by Fairchild Aerial Surveys, Inc.

'Way down yonder in NEW ORLEANS...

217 STRUCTURES *REST ON* RAYMOND FOUNDATIONS

You're looking into the heart of downtown New Orleans from above the Claiborne Street Overpass. In recent years, the Crescent City's skyline has undergone a tremendous change, and beneath many of its new structures are thousands of Raymond piles. In the foreground you see the Texaco, California Company, and Shell Oil Company Buildings . . . all Raymond-supported. In the background, other Raymond foundation installations include: Claiborne Street Bridge, Higgins Shipyard and Kaiser Aluminum & Chemical Company.

While not shown in the picture, the five-mile Seawall on Lake Ponchartrain, the striking Pan American Insurance Building, and the gigantic Desire Street Housing Project are other New Orleans projects that testify to Raymond's wide and diversified experience. For over fifty years, Raymond has completed a variety of contracts, large and small, in major cities across the United States. May we apply this know-how to your next foundation project?

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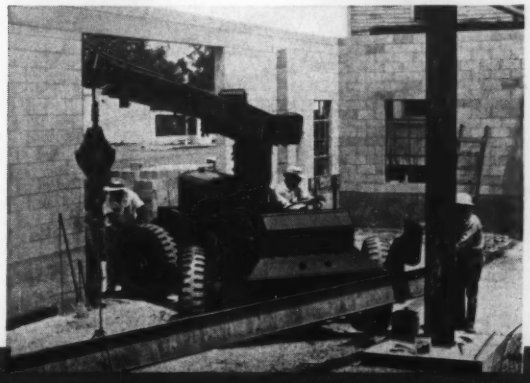

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". . . We haven't spent a cent for repairs in its first 11 months use."

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General Contractor:
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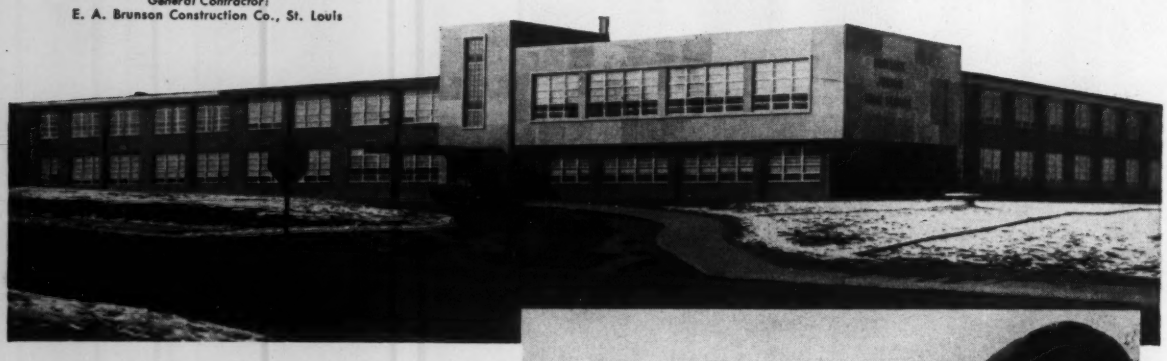
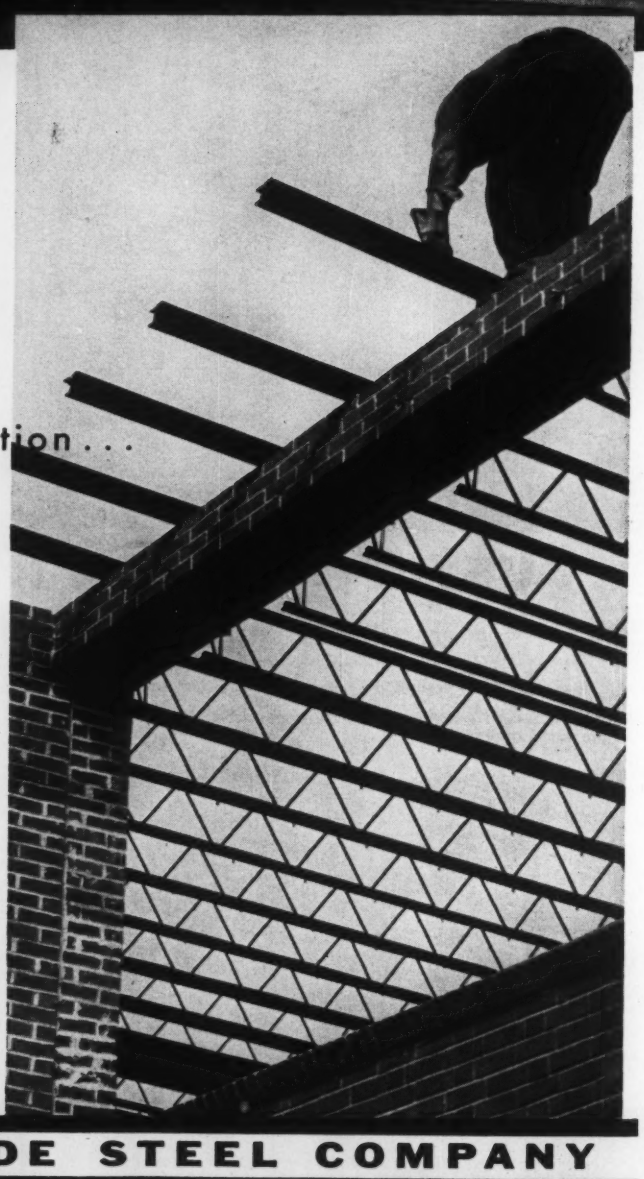


LIGHTNESS AND STRENGTH

combine in LACLEDE open web STEEL JOISTS

for fast, durable construction . . .



Versatile Laclede steel joists were used to their best advantage in this handsome new school in suburban St. Louis.

Laclede joists are easy to handle and place, and are prefabricated to speed the job.

Their high strength and light weight provide substantial savings in foundation and framework. Utility conduits, pipes and lines are easily threaded through the open webs.

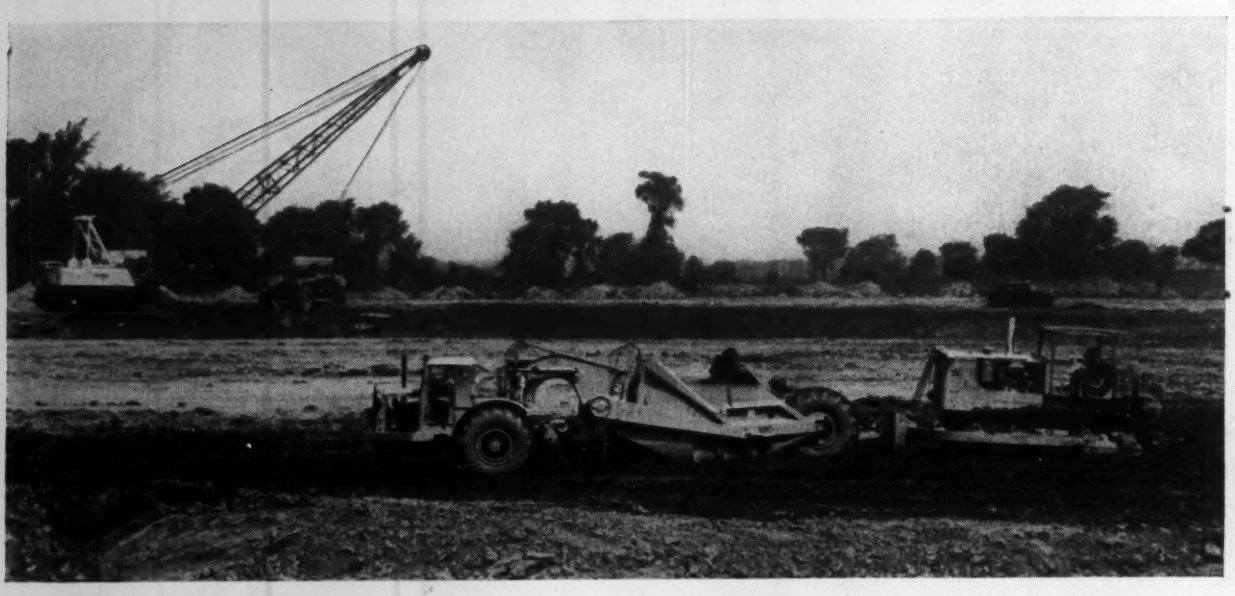
LACLEDE

STEEL JOIST INSTITUTE MEMBER SJI

LACLEDE STEEL COMPANY

SAINT LOUIS, MISSOURI ◆ Producers of Steel for Industry and Construction

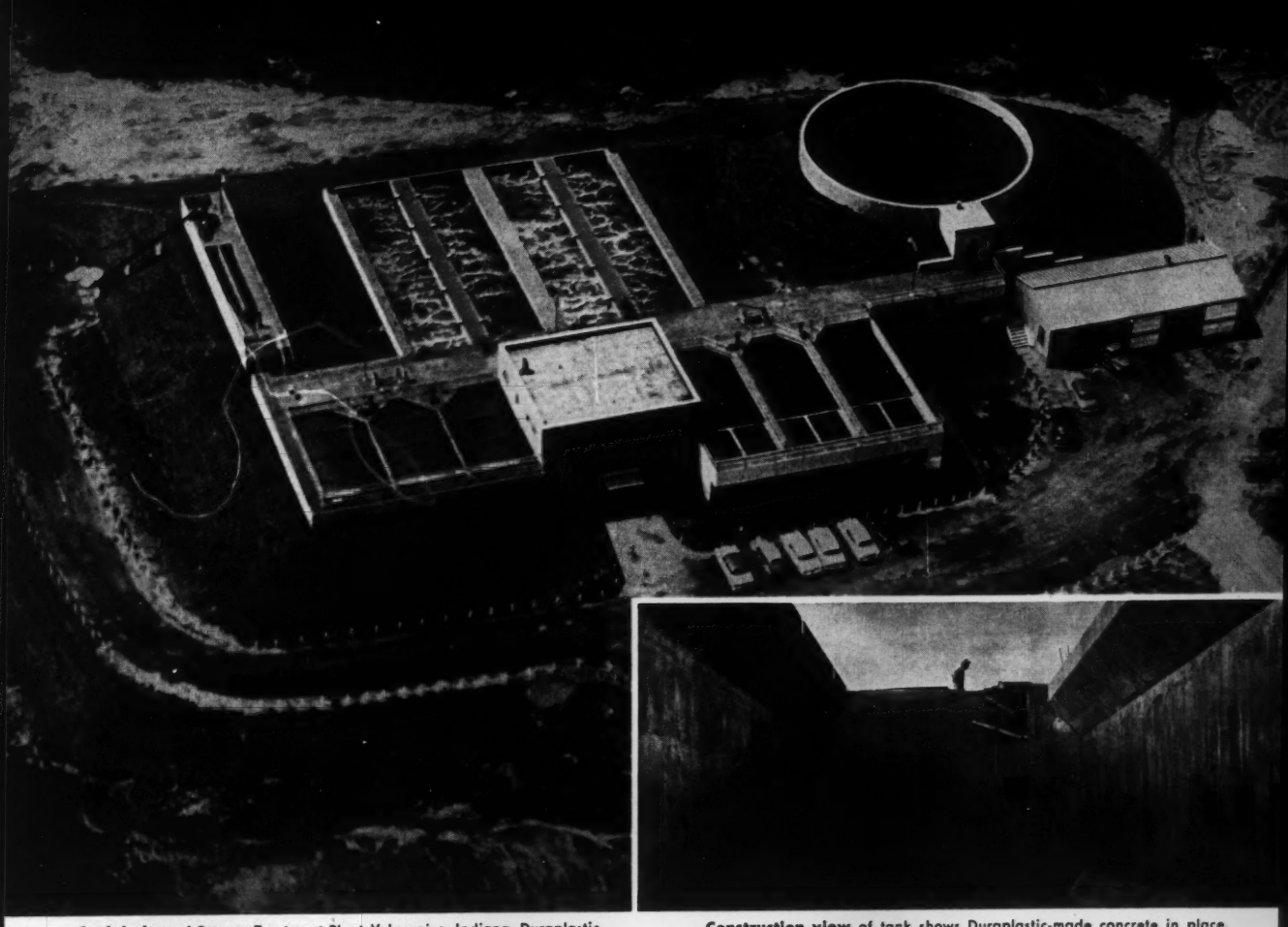
PRODUCTION REPORTS FROM THE



GOOD PERFORMANCE IN STICKY GOING. On Grass River lock and dike construction job, important part of immense St. Lawrence Seaway project, a 286 HP CAT* D9 Tractor push-loads a DW21-No. 21 Scraper. In the background, a Marion dragline with 4-yard bucket, powered by a D375 Engine, loads a DW21 with Movall. Says D. J. Dutcher, Vice President of Dutcher Construction Corp., Queenstown, Md.: "Our D9s are performing very well. We're also proud of the performance of our DW21s and Movalls in this sticky material. The high power of the DW21s is very useful here."

DEPENDABLE POWER DAY AFTER DAY. A Bucyrus-Erie backhoe, powered by a Caterpillar D13000 Engine, digs a reclaim tunnel in the construction of Long Sault Dam, a part of a combined U. S.-Canadian hydroelectric project. Contractor: Walsh, Perini, Morrison, Kiewit, Utah Companies, Massena, N. Y. Jess Fulton, who has been operating earthmoving equipment for 46 years, says: "They don't make 'em any better than Caterpillar, I know—I've tried the others. When I sit down on a machine, I like to have that dependable Caterpillar power behind me."

EXCEPTIONAL PRODUCTION. On a section of Robinson Bay Tunnel Road, a big Caterpillar D8 Tractor-No. 8S Bulldozer unit helps construct two miles of 24' blacktop with a 24" base. The contractor here is S. J. Groves and Sons Co., Minneapolis, Minn. Grading Superintendent Jack Conway, a construction veteran of 34 years, has this to report: "Our Caterpillar equipment has run eight weeks with only four hours of down time. That's exceptional because of the adverse conditions here. You just can't beat Caterpillar equipment no matter what conditions are."



Aerial view of Sewage Treatment Plant, Valparaiso, Indiana. Duraplastic cement provides protection against freezing-thawing weather.

Construction view of tank shows Duraplastic-made concrete in place. Duraplastic gives excellent placeability and durability.

"Our contractors are completely satisfied with Duraplastic*"

. . . said Ready-Mix supplier Byron Smith, President of Smith Nuppnau Ready-Mix, Inc., Valparaiso, Indiana. "Duraplastic's ability to fortify concrete against freezing-thawing weather is outstanding, and the lack of segregation and reduced finishing time please contractors."

You, too, will get more durable, more uniform concrete with Atlas Duraplastic air-entraining portland cement, because you get a more plastic, more cohesive mix. Less mixing water is required for a given slump . . . segregation and water gain are minimized.

YET DURAPLASTIC COSTS NO MORE than regular cement—requires no unusual changes in procedure. Complies with ASTM and Federal Specifications. For descriptive booklet, write:

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UNITED STATES STEEL (USS) CORPORATION SUBSIDIARY

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*"DURAPLASTIC" is the registered trade-mark of the air-entraining portland cement manufactured by Universal Atlas Cement Company.

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Atlas® Duraplastic Cement

CP-D-181-C

MAKES BETTER CONCRETE AT NO EXTRA COST

United States Steel Hour—Televised on alternate Wednesdays—See your local newspaper for time and station.

ST. LAWRENCE SEAWAY

Contractors, Project Managers, Superintendents and Operators Appraise Caterpillar Performance on Continent's Greatest Construction Project

Here are a few of many firsthand reports on the performance of hundreds of Caterpillar units working on the St. Lawrence Seaway project. These reports cover rugged yellow equipment across the board, from tractors and scrapers to motor graders and engines in earthmoving machinery. And they all add up to this: *Whenever* and *wherever* you have a job to do, you can count on *any* Caterpillar unit to come through for you with money-making production. You can also count on your nearby Caterpillar Dealer to back you with prompt on-the-job service.

To meet your needs, Caterpillar offers you an array of new products developed to work longer and more profitably than any other equipment on the market. For complete information about them, see your Caterpillar Dealer. Name the date—he'll be glad to demonstrate!

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

CATERPILLAR*

*Caterpillar and Cat are Registered Trademarks of Caterpillar Tractor Co.

USE CAT EQUIPMENT FOR MONEY-MAKING PRODUCTION

MINIMUM MAINTENANCE AND MINIMUM DOWN TIME. Building a dike at Victoria Bridge and Jacques Cartier Bridge, a Cat DW21 Tractor with an Athey PR21 Wagon hauls rock, while a D8 Tractor-No. 8S Bulldozer handles the 'dozing job. The contractor is McNamara-Pigott-Peacock-McQuigge of Montreal, Canada. Project Manager M. L. Sproule, 35 years a construction man, says: "We get good production with a minimum of maintenance and down time from Caterpillar units—and I'd say that our Caterpillar Dealer's service is the tops."

STAYS ON THE JOB. A Cat No. 12 Motor Grader is kept busy building access roads to the St. Lawrence Seaway project near Massena, N. Y. The contractor: Torrington Construction Co., Inc., Torrington, Conn. Superintendent Theron Jenson says: "You will have to go a long way to get machines that will outperform and stay on the job for you as do Caterpillar Diesel Motor Graders and Tractors."

Your
Brunson Instrument

Stays Accurate Where Others Fail!

Engineer's
Transit Model 50

DUSTPROOF BALL BEARING CONSTRUCTION Makes the BIG Difference!

As every experienced operator knows, the problem in surveying instruments has not been to get accurate instruments, but to *maintain* their accuracy and operability. It took Brunson, with a radical departure from old, "conventional" basic designs, to come up with the answer — dustproof ball bearing construction!

Located in the spindle and telescope axis, Brunson ball bearings are permanently lubricated by an all-temperature grease and sealed against dust and moisture. Preloaded and accurate to 5-millionths of an inch, these ball bearings provide highest possible instrument accuracy. With dust sealed out and lubricant sealed in, wear is practically eliminated by the smooth ball bearing action. That's why your Brunson instrument stays accurate and operable year-in-and-year-out, where others fail. You save hundreds of hours in on-work time, avoid costly errors, slash routine repair and maintenance expense to a level undreamed of in the past.

You pay no more for Brunson instruments with exclusive ball bearing construction. Mail coupon today.

You Get These Advantages, Too!

Wobble Pin in Tangent Screw Point—Enables your Brunson instrument to stay "on point" by eliminating strain and wear points that cause slippage.

Long and Short Shots in Collimation — Long and short shots are all in exactly the same straight line.

Sturdy, Heat Treated Cast Truss Standard — Can support over 200 pounds without bending or warping.

Extra-Strong Fiberglas Cross Wires. Sharp Focus, Coated Lens System. Wide Field of View. Flush Filled Graduations. Covered Replaceable Leveling Screws.

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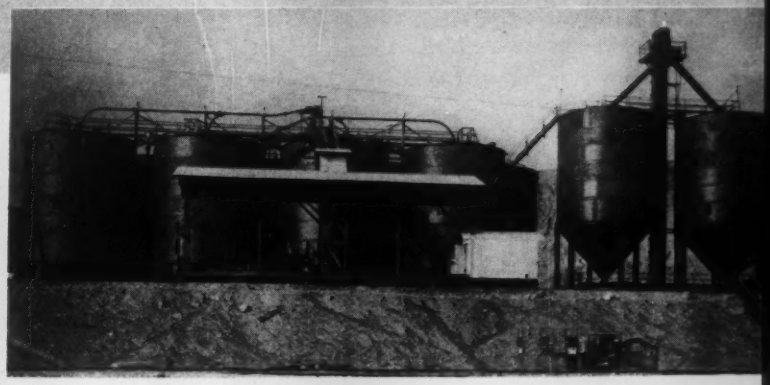
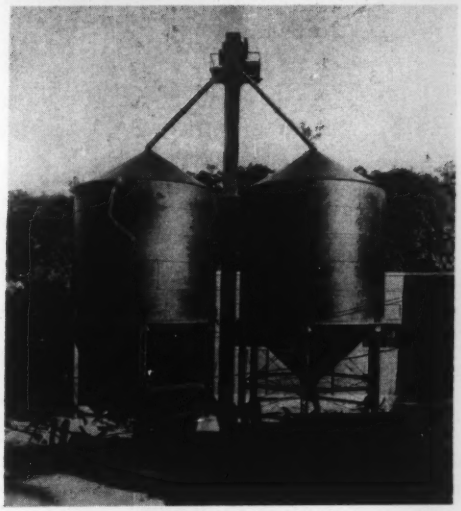
for ECONOMICAL storage of **FREE-FLOWING DRY MATERIALS**





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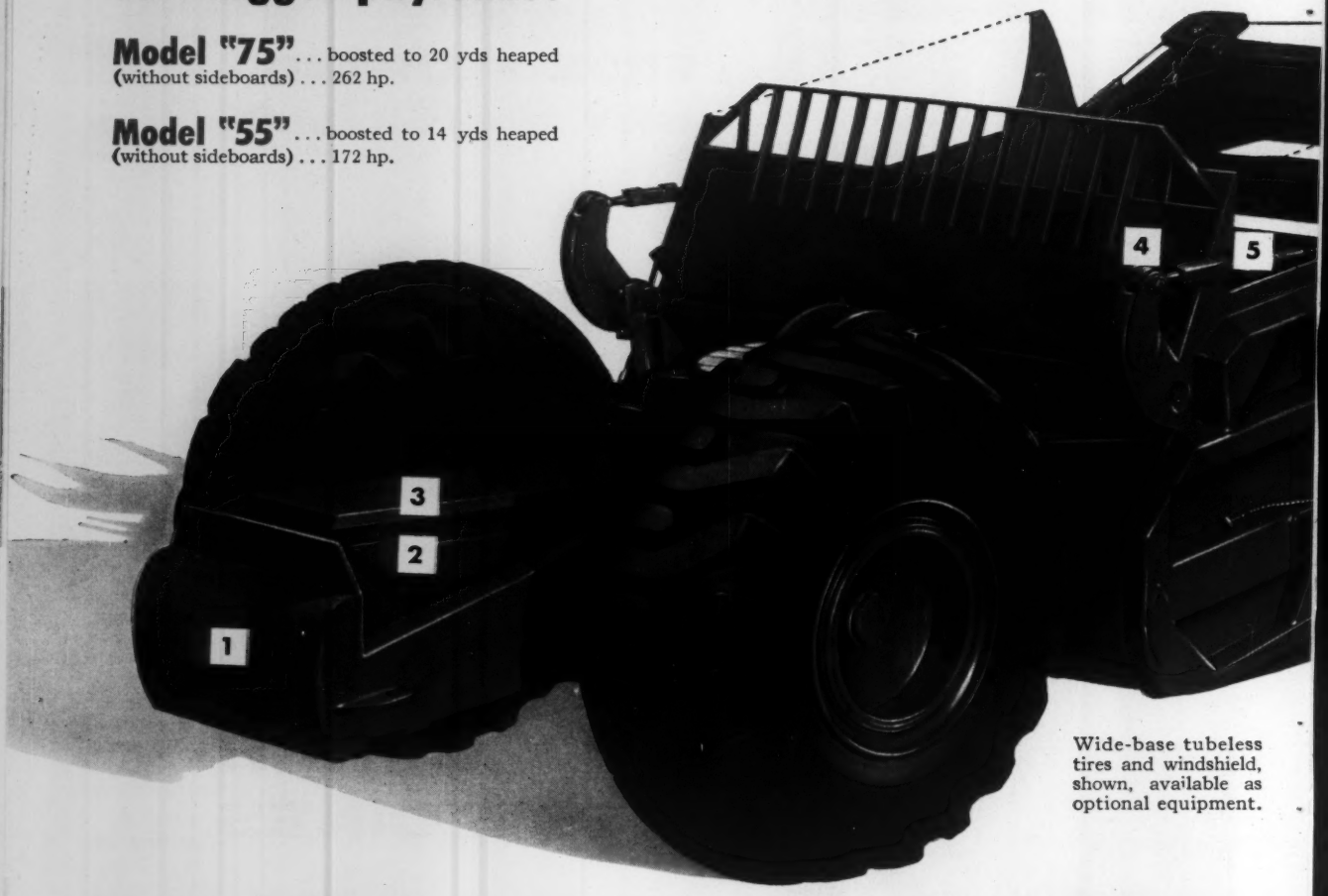
NOW *bid beating... dirt heaping...* 1956

10% bigger payloads!

Model "75"... boosted to 20 yds heaped (without sideboards)... 262 hp.

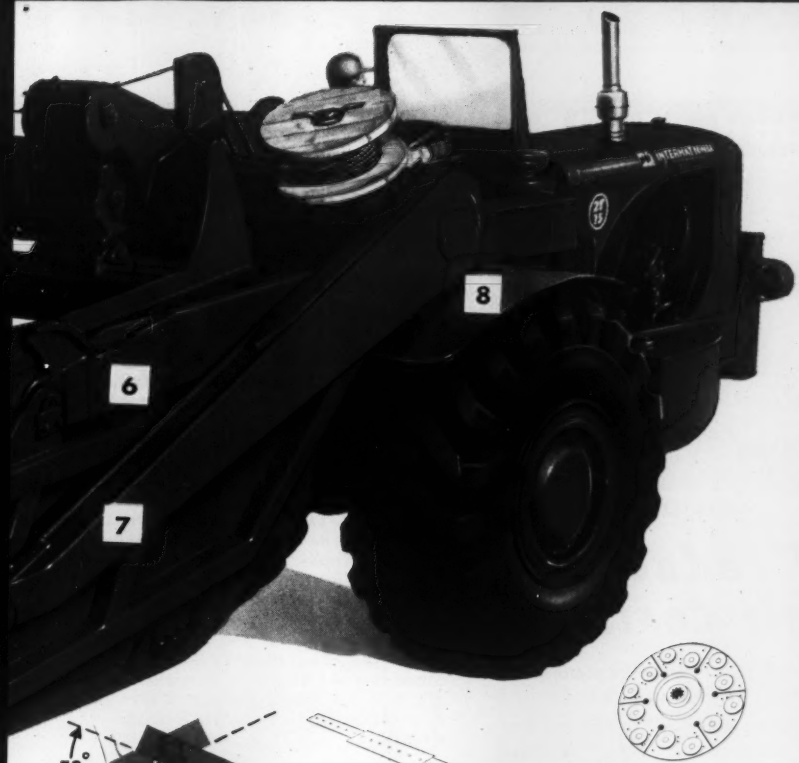
Model "55"... boosted to 14 yds heaped (without sideboards)... 172 hp.



Wide-base tubeless tires and windshield, shown, available as optional equipment.

1. **Wider "Target" Push-Block** makes it easier to make and maintain contact. Helps to cut loading and cycle time.
2. **Straight-Line Ejector Reeving** requires minimum power; leaves more power on Payscraper wheels for faster dumping and spreading. Also speeds re-threading time.
3. **Sturdy Cover Plates** protect new, stronger cylindrical ram and air tanks.
4. **New, Straight-Back Bowl** lets you heap and haul more dirt every trip. Struck capacity, *with sideboards*. 18 cubic yds on "75"—12 cubic yds on "55".
5. **Higher Apron Lift,** bigger apron opening, provides cleaner, more rapid dumping, especially of "sticky" materials.
6. **Fast-Acting Apron,** arms mounted outside bowl, assure quick, positive closing of apron. Payscraper holds the load from cut to fill.
7. **Lowered Draft Frame** provides operator with "control tower" visibility of bowl and push-tractor... also helps direct push and pull power more efficiently to cutting edge for faster loading.
8. **Larger, Wider Fenders** give greater safety for operator, greater protection for machine.

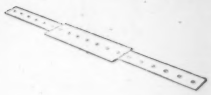
International Payscrapers®



Put the 1956 International Payscraper to work on your job, and watch dirt boil up into its new, straight-back bowl. You've never seen any big scraper load as easily or as fast. In seconds, you've packed in up to 23 heaped yards. Its offset 3-section blade breaks the ground like a sharp-pointed spade. Dirt boils from the smooth-slicing cutting edge and fills the corners to build a full heaped load. Close the apron instantly, positively, on this huge, well-compacted load and you carry all the dirt you've heaped in.

Now, drive easily, effortlessly with safe hydraulic power steering at a fast clip to the fill. Note how the 1956 Payscraper's extremely high ratio of horsepower to capacity and its rapid acceleration to 24 mph top speed add up to more trips per hour than any other self-powered scraper you've ever used. Yes sir, it's a real profitable dirtmover, this 1956 Payscraper! Try one yourself on your job! See your International Industrial Power Distributor for a demonstration.

Maximum 52° Oscillation
from right to left takes the stress and strain out of hauls over furrows, rough ground.



Adjustable 3-Piece Cutting Edge
for clean, fast cutting and loading under all soil conditions.

New, Long-Lasting Clutch
of ceramic material and powdered metals, successfully resists heat and wear over longer periods. Available on Model 75 only.

INTERNATIONAL HARVESTER

International Industrial Power

A COMPLETE POWER PACKAGE INCLUDING: Crawler, Wheel, and Pipe-Boom Tractors . . . Self-Propelled Scrapers and Bottom-Dumps . . . Tractor and Rubber-Tired Loaders . . . Diesel and Carbureted Engines . . . Farm Machinery . . . Motor Trucks.

NEWS OF ENGINEERS

James F. Beeson has been elected vice-president of the Cunningham-Limp Co., general contractors of Detroit, Mich. He will continue as vice-president and treasurer of Cunningham Engineers, Inc. Prior to joining the organization in 1946, Mr. Beeson was on the engineering faculty of the University of Alabama. His duties will include increased management responsibilities.

Herbert C. Gee announces that Gee & Jenson, Inc., construction engineers of West Palm Beach, Fla., have moved their offices to 117½ S. Dixie, West Palm Beach.

Orson W. Israelsen has gone to Teheran, Iran, where he will serve for the next few months as consulting engineer on irrigation and drainage to Utah State College Agricultural College men on the U.S.D.M. to Iran. He has just completed a year as professor of irrigation engineering at the University of Roorkee, Roorkee, India.

Tadius J. Gutt, Austin, Tex., formerly vice-president and general manager of the Texas Stressed Concrete Corp., has been appointed assistant to the president of the George Rackle & Sons Co., 85-year-old structural concrete manufacturers of Cleveland, Ohio. A pioneer in the prestressed concrete field, Mr. Gutt participated in the design and building of the first two prestressed bridges in the nation —the Walnut Lane Bridge in Philadelphia and the Arroyo Seco Bridge in Los Angeles. He has also acted as consultant to the AEC and the Navy. In his new capacity he will help introduce the prestressed structural form to the Great Lakes area.

Tadius J. Gutt

Fremont S. Tandy, Colonel, U. S. Army Corps of Engineers (retired), has joined the Pacific Intermountain Express Co. as director of real properties. He will be responsible for the construction, alteration, and maintenance of all the terminals and offices of his company and its subsidiary, West Coast Fast Freight, including the completion of a $1,500,000 terminal in Los Angeles. He retired from the Corps of Engineers in 1954 with the rank of colonel after thirty years as regular Army officer.

Carlton S. Proctor, of New York, Past-President ASCE and partner in Moran, Proctor, Mueser & Rutledge, engineering firm of New York City, has been elected president of the American Institute of Consulting Engineers succeeding **Francis S. Friel,** of Philadelphia. Others elected are **Richard Hazen** and **Robert W. Abbett,** both of New York, vice-presidents; and **Herschel H. Allen,** of Baltimore, and **Ellis E. Paul** and **Maurice R. Scharff,** of New York, members of the governing Council. All are members of ASCE.

John R. Snell announces the opening of a new firm of consulting engineers, John R. Snell and Associates, with offices at 6103 Lake Lansing Drive, Haslett (East Lansing), Mich. Mr. Snell has been head of the civil and sanitary engineering department at Michigan State University in East Lansing for the past four years, and previously was chief engineer and president of Engineering Services, Inc., consulting engineers of Boston.

FOR BRIDGES and PIERS

BEFORE DRI-POR

AFTER DRI-POR

How DRI-POR® reduces your Pile-Repair Costs:

Lasting repair of bridge or pier piling eroded in the tidal range is now a routine procedure using the "DRI-POR" system of pile encasement.

The "DRI-POR" system utilizes a patented "K Box" which allows the repair of damaged piles below the water line "in the dry". This results in the following advantages not enjoyed by any other existing procedure.

- Removal of all decayed concrete
- Welding of replaced reinforcing
- No contamination of pile repair
- No expensive diving procedures
- Leak proof, watertight forms
- No tremie or grouting required
- Visual inspection by inspector
- Control of repair at all times

In addition, "DRI-POR" admixtures and low water-cement ratios increase density, impermeability and frost and chemical resistance of the concrete encasement.

With these many advantages, initial costs are reduced and life of repair lengthened. In other words, "DRI-POR" gives you the best repair at lowest cost. If you have a pile repair problem, it will pay you to learn more about "DRI-POR." Write for information, specifications and a pamphlet describing the repair of the 5 mile long *James River Bridge System.*

DRI-POR SYSTEMS
An exclusive process of
MASONRY RESURFACING AND CONSTRUCTION CO. INC.
BALTIMORE 26, MD.

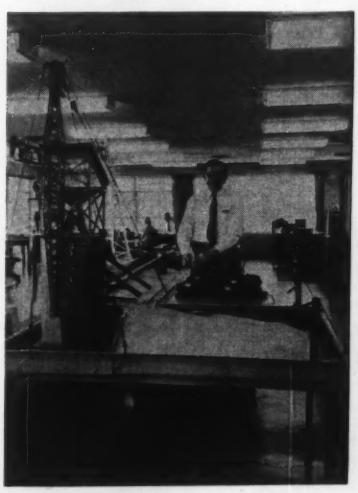
John O. Morton has been appointed by Governor Dwinell to succeed the late Maj. Gen Frank D. Merrill as New Hampshire highway commissioner. Mr. Morton first joined the Highway Department in 1922, left in 1946 to found the New Hampshire Sand and Gravel Co., and returned in 1949 as deputy commissioner. He was first president of the New Hampshire Branch of the Maine Section.

Kenneth B. Woods head of the School of Civil Engineering, Purdue University, was recently elected chairman of the executive committee of the Highway Research Board, Washington, D. C. Mr. Woods who is also director of the Joint Highways Research Project at Purdue, succeeds **G. Donald Kennedy,** who has served as Board chairman for the past two years. Mr. Kennedy is president of the Portlant Cement Association of Chicago.

Roy G. McGlone, chief of the Operations Division of the Southwestern Division of the Corps of Engineers, Dallas, has retired after 48 years of service. As a civilian and officer in both World Wars, Mr. McGlone has filled many important assignments in the Corps.

Howard Lowenstein, of Wantagh, N. Y., who is serving with the 86th Engineer Construction Battalion at Fort Dix, N. J., has been promoted to first lieutenant. He is a graduate of City College of New York and has been in the Army since June 1954.

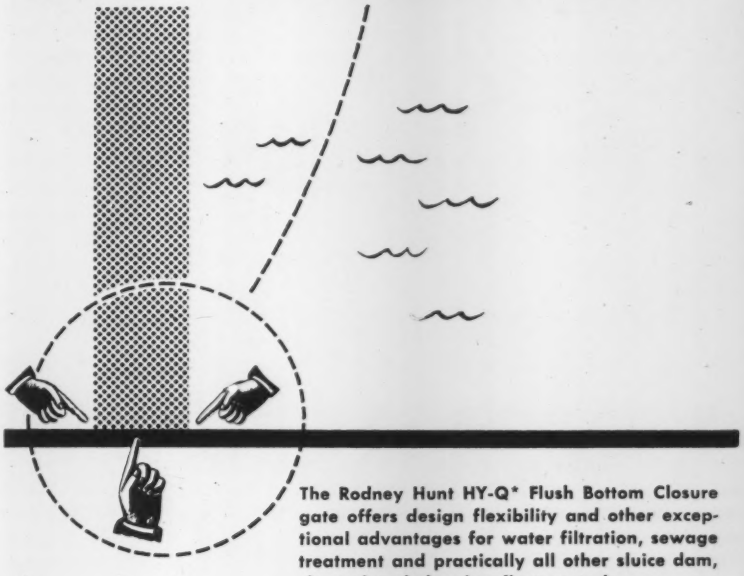
Louis E. Dierks recently retired from active duty with Sauerman Bros., Inc., Chicago, Ill., after 42 years of service. A vice-president and member of the board of directors, he will remain with the company as a consultant.



Mr. Dierks poses with scale models he has made of Sauerman equipment he has been instrumental in developing in his 42 years with the company.

(Continued on page 25)

the HY-Q Sluice Gate seats flush on the bottom of the channel!



The Rodney Hunt HY-Q* Flush Bottom Closure gate offers design flexibility and other exceptional advantages for water filtration, sewage treatment and practically all other sluice dam, channel and chamber flow control.

1. You get maximum flow because there is minimum turbulence at the point of greatest head.
2. You get *complete* drainage naturally; no need for pumps and piping to get out water trapped behind a sill.
3. You get maximum clear opening because full flow at every raising of the gate sweeps the channel clear of silt and debris.
4. You get maximum hydraulic gradient because the HY-Q gate seats at the lowest level of the channel.

Send for a new 12-page catalog — No. 75 — giving complete description and specifications of the patented Rodney Hunt HY-Q Flush Bottom Closure Sluice Gate.

*HY-Q is a trademark of Rodney Hunt Machine Co.

RODNEY HUNT MACHINE CO.
Water Control Equipment Division
86 LAKE STREET, ORANGE, MASSACHUSETTS, U.S.A.

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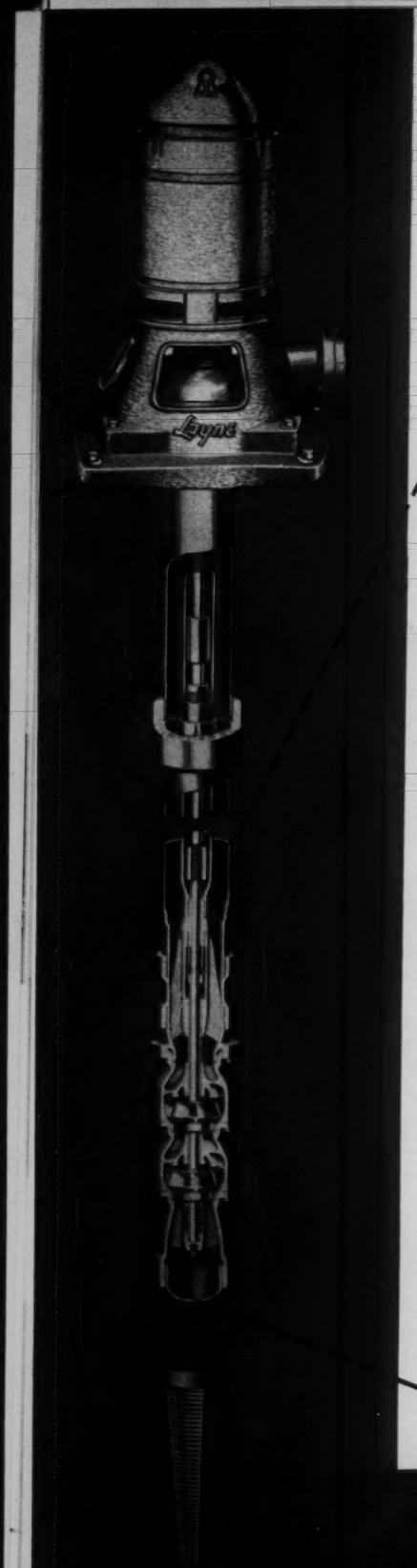
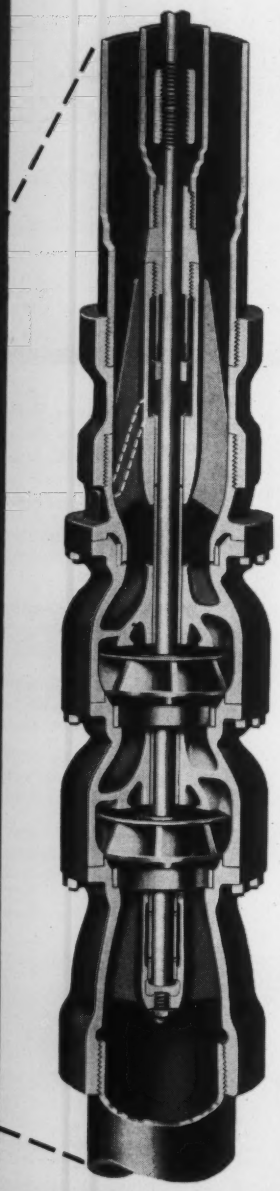


Precision Built from Performance-Proven Design



The basic design of Layne vertical turbine pumps has been tried and proved under all kinds of operating conditions, both good and bad, the world over.

The finished pumps are produced by skilled craftsmen, in one manufacturing plant, using highest standards—Layne standards.

Industries, municipalities and agriculturalists can rely on the fact that it is prudent and safe to rely on Layne.

For example, consider Layne pump bowls—the very heart of a pump.—

- ★ Designed by top flight hydraulic engineers, the best available anywhere.
- ★ Heavy, rugged construction to give long service under gruelling conditions.
- ★ Clean, smooth flowing water passages in intermediates and hand-finished impellers for high operating efficiencies throughout long operating life.
- ★ Careful and continuous production control from design board to shipping crate—nothing left to chance.
- ★ Produced with the prime objective of pumping water at minimum operating cost—BETTER BUILT FOR BETTER SERVICE.

LAYNE
& BOWLER, INC.
MEMPHIS
General Offices and Factory

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

News of Engineers

(*Continued from page 23*)

William T. Hooper, Jr., has recently been admitted to membership in the American Institute of Architects. Mr. Hooper has a consulting architectural and engineering office in Waukegan, Ill., specializing in the design of public works and buildings.

Theodore J. Kauer, until recently chief engineer for the Ohio Turnpike Commission on construction of the Ohio Turnpike, has accepted the position of chief engineer of the Holmes Construction Co., Wooster, Ohio. Before his Ohio Turnpike assignment Mr. Kauer was director of highways for the State of Ohio.

Melvin L. Koehler, of Lucasville, Ohio, formerly with the U. S. Bureau of Reclamation, the Iowa Ordinance Plant at Burlington, Iowa, and the AEC plant at Portsmouth, Ohio, was recently appointed civil engineer for the consulting engineering firm of Floyd G. Browne and Associates, Marion, Ohio.

Manuel J. Asensio, Lieutenant General, U. S. Air Force, has been appointed by the President to three-star rank, and selected to be the Deputy Chief of Staff, Comptroller, at headquarters, U. S. Air Force, Washington, D. C. General Asensio, a 1927 graduate of the U. S. Military Academy, received his B.S. in civil engineering from the University of California, and at the time of his transfer to the United States Air Force in 1947 was in the Corps of Engineers. Recently he was vice-commander of the Continental Air Command, with headquarters at Mitchell Air Force Base, Long Island, N.Y.

General Asensio

Joseph H. Ehlers, assistant commissioner for technical services, Urban Renewal Administration, in Washington, D.C., has been commissioned a sanitary engineer director in the Public Health Service Commissioned Reserve. Until recently Mr. Ehlers was ASCE Field Secretary in Washington, D.C.

Ralph Stone, consulting engineer, announces the removal of his engineering office, Ralph Stone and Company, to 147 San Vicente Boulevard, Beverly Hills, Calif. A widely known authority on water and waste water treatment, and reclamation, Mr. Stone is a holder of the Rudolph Hering Award.

M. C. Boyer has resigned as associate professor of mechanics and hydraulics at the State University of Iowa and is now in charge of hydrologic investigations for the Indiana Flood Control and Water Resources Commission in Indianapolis.

(*Continued on page 26*)

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possible only with
MARS-LUMOCHROM
All colors blueprint perfectly, making color-drafting possible.
MARS-LUMOCHROM does not fade
. . . does not smear . . . is waterproof
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Send for free sample
STAEDTLER also proudly introduces the Mars-Pocket-Technico for field use, the Mars "Draftsman's" Pencil Sharpener with the adjustable point length feature, and the efficient, clean Mars lead sharpener. All available—along with the established standards: Mars-Lumograph black graphite drafting pencils, Mars-Technico lead holder and leads, and Tradition-Aquarell painting pencils—at all leading art material and drafting supply dealers.
J.S. STAEDTLER INC. HACKENSACK, NEW JERSEY
GERMANY
24 COLORS—$1.50 PER DOZEN, LESS IN QUANTITY
J.S. STAEDTLER MARS-LUMOCHROM GERMANY

News of Engineers

(*Continued from page 25*)

Robert C. McDowell has been elected president of the Wellman Engineering Co., Cleveland engineering and machinery fabricating firm. He is also president of McDowell Co., Inc., industrial engineers and contractors specializing in turnkey construction of mechanical plants for basic industries delivered in operation.

David B. Steinman, internationally noted bridge engineer of New York, has received two new decorations from the French Government—the Cross of Commander of the Order of Merit and Education and the Cross of High Officer of the Order of Merit for Research and Invention.

George W. Paulette has taken over new duties as municipal sales division manager of Infilco Inc., at Tucson, Ariz. Mr. Paulette has been with the company 24 years as a district and field engineer, with headquarters in Kansas City, New Orleans, Cleveland, and Orlando, Fla.

Leslie A. Irvin, civil and structural engineer of Los Angeles, has been appointed Los Angeles production manager of Daniel, Mann, Johnson, & Mendenhall. In his new capacity Mr. Irvin will help direct construction of school buildings for some 30 districts in the Southwest, and design of 56 new supermarkets for a grocery chain. In addition, he will participate in numerous design and engineering projects undertaken for the Army, Navy and Air Forces.

Leslie A. Irvin

Louis G. Feil, chief of the Engineering Division and ranking civilian employee of the Kansas City District of the Army Corps of Engineers was recently selected as "man of the year" among the 12,000 federal employees in Greater Kansas City. A dinner, held at the Kansas City Record Center, formally honored Mr. Feil as "federal civil servant of Greater Kansas City for 1955." He is an authority in all fields of water conservation.

Edward R. Sanner of Knoxville, Tenn., has been transferred by the Southern Railway Co. to Atlanta, Ga., where he is now assistant to the chief engineer, Maintenance of Way and Structures, with offices in the Terminal Building.

Lawrence J. Lincoln, Colonel, Corps of Engineers and acting Fourth Army Chief of Staff, will become Mediterranean Division Engineer, Corps of Engineers, on May 1, upon the retirement of **Brig. Gen. B. B. Talley** after 30 years of service. Colonel Lincoln has been at Fort Sam Houston since August 1954, serving successively as Fourth Army engineer, deputy chief of staff for operations, and acting chief of staff.

(*Continued on page 28*)

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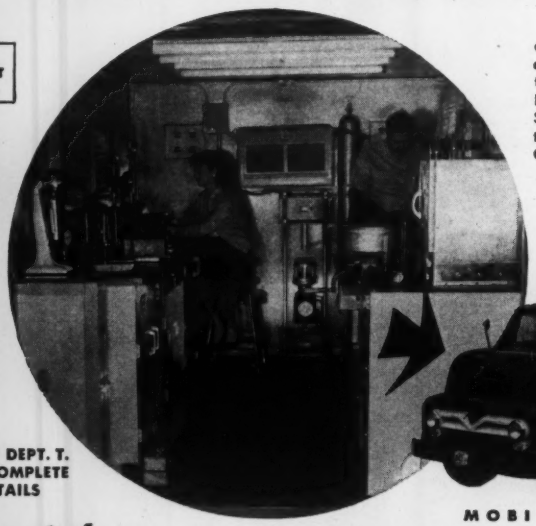

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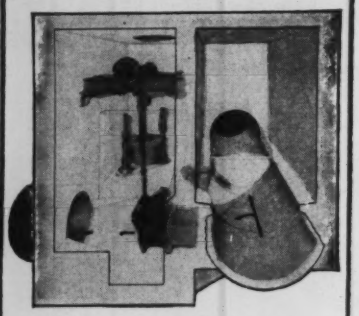

Fig. B-19

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News of Engineers

(*Continued from page 26*)

William W. Davis, consulting engineer, formerly in charge of construction for the Eastern territory of Sears, Roebuck and Co., Philadelphia, Pa., and **V. C. Patterson,** formerly with V. C. Patterson and Associates, Inc., York, Pa., have become associated in a partnership under the name of Patterson and Davis. The firm is located in Philadelphia and specializes in design and supervision of construction of cold storage, frozen food, dairy and meat plants.

Henry C. Goodrich has been elected vice-president of the Rust Engineering Co., Pittsburgh, Pa., in charge of sales and estimates for the company's Birmingham, Ala., office. He joined the firm in 1946 as a structural engineer and later was project manager on a number of the company's major construction projects.

Vincent B. Lamoureux, sanitary engineer director, Public Health Service, who has been assistant chief, Near East and Africa Branch, Public Health Division, International Cooperation Administration, in Washington, D.C., left in February to become a member of the U. S. Operations Mission to Uruguay, where he will advise on urban and rural sanitary engineering problems. He will also instruct university students in public-health engineering. Mr. Lamoureux's new address will be Health Welfare and Housing Field Party, USOM of Uruguay, c/o American Embassy, Montevideo, Uruguay.

V. B. Lamoureux

Royal W. Davenport, chief, Technical Coordination Branch of the Water Resources Division, U. S. Geological Survey, Washington, D.C., retired recently after 45 years of government service. Though Mr. Davenport's employment with the Survey was continuous, from 1920–1928 he was assigned to the Federal Power Commission to carry out power studies necessary to administration of the Federal Power Act. An outstanding authority in his field, Mr. Davenport served as adviser to the Department of State and the International Joint Commission on water resources problems along the Canadian boundary.

Charles E. Carlson, Jr., of the Bronx, N.Y., has been promoted to first lieutenant in the 86th Engineer Construction Battalion, Fort Dix, N.J. He is a graduate of City College of New York and has been in the Army since June 1954.

Frederick A. Dale, consulting hydroelectric engineer of Cashiers, N.C., returned home recently from Formosa, after completion of a one-year special assignment for the J. G. White Engineering Corp., of New York City.

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RECENT BOOKS

ASTM Standards on Cement

This compilation includes 37 specifications and methods of test, of which 18 have been revised since the 1954 edition and five are new. The publication also contains information on analytical balances and weights, a manual of cement testing, a list of selected references on portland cement, and other data. (American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa., 1955. 270 pp., $2.75.)

An Introduction to Fluvial Hydraulics

A brief summary by Serge Leliavsky, of various theories, methods, and facts relating to the flow of water in erodible channels. The subjects include sediment transportation; the difference between traction and suspension; correlation between surface slope and particle size; dunes and ripples; scour criteria; bed-load; side slope stability; and three-dimensional characteristics of the water flow in rivers. (Oxford University Press, 114 Fifth Ave., New York 11, N.Y., 1955. 257 pp., $4.80.)

Annual Review of Nuclear Science, Vol. V, 1955

The present volume contains reviews of advances in fourteen areas of the field, accompanied by extensive lists of cited references. Typical papers deal with radiation shielding, nuclear particle detection, design comparison of reactors for research, and mass spectrometry. Author and subject indexes to this year's volume, and indexes to chapter, authors, and titles of Vols. I to V are included. Edited by James G. Beckerley. (Annual Reviews, Stanford, Calif., 1955. 448 pp., $7.00.)

Architectural Engineering

A compilation of articles selected from issues of *Architectural Record* for the past nine years, arranged in six sections devoted to the building shell, environmental control, utilities, site planning, materials, and special problems such as fire protection and blast-resistant buildings. The articles have been chosen to provide up-to-date, detailed, and specific information on the more active areas of technical development, including thin-shell construction, heat pumps, parking planning, lightweight concrete, and many others. The book is fully illustrated and has a detailed index. (F. W. Dodge Corp., 119 West 40th St., New York 18, 1955. 494 pp., $11.50.)

Basic Mathematics

This book presents the topics from algebra, trigonometry, and analytic geometry that are needed for the study of elementary science and engineering. It deals with numerical computations, the slide rule, graphs of trigonometric functions, vectors, exponents, radicals, logarithms, and other selected subjects. Many worked out examples and over 7000 exercises are included. The authors are Paul G. Andres, High J. Miser and Haim Reingold. (John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N.Y., 1955. 846 pp., $6.75.)

Das Cross-Verfahren

A comprehensive new treatment, by Johannes Johannson, of the Hardy Cross method of analysis of rigid frames by the moment distribution method. A feature of the book is the fully worked out numerical examples for various types of structures. Edited by Günter Raczat. (Springer-Verlag, Berlin, 1955. 168 pp., D.M. 17.40.)

Fundamentals of Transportation Engineering

Major sections of this survey of the civil engineering aspects of transportation are devoted to roads and pavements, and to airport, railroad, and river and coastal engineering; briefer sections deal with pipelines and belt conveyors. The book includes design and layout data, and planning and construction standards and procedures of value to both students and practicing engineers. The authors are Robert G. Hennes and Martin I. Ekse. (McGraw-Hill Book Company, Inc., 330 West 42nd St., New York 36, N. Y., 1955. 520 pp., $8.50.)

Hydraulic and Pneumatic Operation of Machines

The first part of this book by H. C. Town provides practical information on pumps, valves, circuits, and rotary drive; hydraulic machine tool operation; and hydraulic presses. Also dealt with in this part are general features of the design of cylinders, pipelines, and protection devices; hydrokinetic automobile transmission; automotive controls; and hydraulic accumulators. The second part of the book covers air compressors; pneumatic tools; the design of pneumatic circuits; hydro-pneumatic operation; and applications of air control to jigs and fixtures, brakes, clutches, conveyors, and aircraft components. (Philosophical Library, Inc., 15 East 40th St., New York 16, 1956. 192 pp., $7.50.)

Les Barrages En Voute Mince

The author, Jean Lombardi, develops in a systematic manner a method of analysis for the thin arch dam in accordance with standard shell theory, with particular attention to torsion effects. Realistic examples are dealt with, and a step-by-step calculation is carried out. The general method developed is compared with the classic method of arch dam analysis. (F. Rouge & Cie, Lausanne, France, 1955. 163 pp., Sw. fr. 28.70.)

Metals Handbook

The second in a series of supplements issued in order to make important material available sooner than would be the case if it were held until the revision of the 1948 Handbook is completed. Various aspects of materials and applications, design, processing, fabricating, testing, and inspection are dealt with in articles which are either entirely new or are revised treatments of subjects previously covered. Edited by Taylor Lyman. (American Society for Metals, 7301 Euclid Ave., Cleveland 3, Ohio, 1955. 208 pp., $6.00.)

National Research Council, Highway Research Board, Proceedings of the Thirty-Fourth Annual Meeting

These proceedings contain more than forty papers devoted to specific topics in the fields of design, materials, construction, traffic, and soils. The individual papers deal with such subjects as dowel installations, model studies of pile foundations, traffic paint, asphalt paving mixes, traffic volume determination, and chemical soil stabilization. The proceedings also include a list of current Highway Research Board Publications. (National Research Council, 2101 Constitution Ave., Washington 25, D.C., 1955. 648 pp., $8.50.)

Orientation in Engineering

With the aim of helping students to adjust to college life, to clarify their ideas of the engineering college and profession, and to learn fundamental skills, this book considers such topics as classroom honesty, extra-curricular activities, studying, examinations, the use of libraries, the slide rule, and dimensional analysis. It also discusses the development of the engineering profession, engineering specialization, and the function of engineering education. Written assignments at the end of each section provide a basis for class discussion. The authors are Murray I. Mantell, Milton E. Reeder, and John A. Stevens. (Prentice-Hall, Inc., Englewood Cliffs, N.J., 1955. 85 pp., $1.75.)

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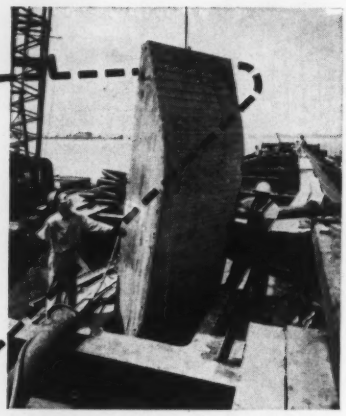
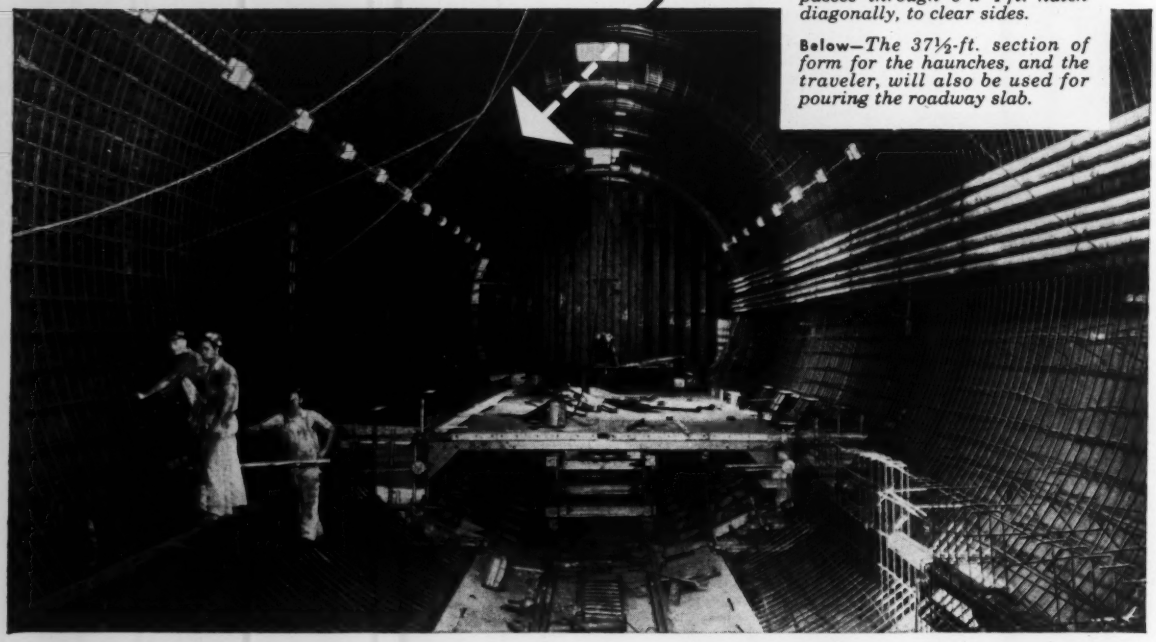


Above—*Blaw-Knox sidewall form passes through 6 x 4-ft. hatch diagonally, to clear sides.*

Below—*The 37½-ft. section of form for the haunches, and the traveler, will also be used for pouring the roadway slab.*



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do you know that

ASCE has just sponsored its first plastics program? At the recent Dallas Convention the Plastics Committee of the Engineering Mechanics Division sponsored a session dealing with both structural and non-structural uses of this important material. One of the plastics papers—by Prof. Albert G. Dietz, chairman of the Plastics Committee at MIT—appears in this issue.

A new Egyptian dam will dwarf the Pyramids? A projected High Dam at Aswan—a fifteen-year project for harnessing Nile waters at a point about 550 miles south of the Mediterranean coast line—will be 250 ft high at the center and more than three miles long, making it one of the biggest single construction projects yet devised. Construction of this mighty irrigation dam is about to begin with an International Bank loan.

The annual cost of running the government comes to about $1,300 per family? This is too much, the Second Hoover Commission reports. Its findings of special interest to engineers were discussed at the recent Second General Assembly of Engineers Joint Council (page 68). Papers presented at the assembly by Rear Admiral Ben Moreell, Hon. M. ASCE, and S. C. Hollister, M. ASCE, are scheduled for a future issue.

Solar energy has come of age? This is the conclusion of Stanford Research Institute, reporting (in its January "News Bulletin") two recent large-scale Conferences on Solar Energy in Arizona. The 120 reports and papers dealt with the major fields to which equipment manufacturers can turn—high-temperature furnaces, solar stills, conversion to mechanical and electrical energy, application of solar space heating and cooling, and other conversion processes. Sponsoring groups, in addition to the SRI, were the Association for Applied Solar Energy and the University of Arizona.

Benjamin Franklin was the first to suggest teaching technical subject in schools and colleges? This new evidence of Franklin's far-reaching outlook has inspired Philadelphia's Franklin Institute to make the first major event of the Benjamin Franklin 250th Anniversary Year a timely drive to help relieve the world's critical shortage of young scientists, engineers, and technicians.

All the Society's thirteen Technical Divisions contributed to the Dallas Convention program? Many important Texas projects, with emphasis on different media of transportation, were covered in the technical program, which is summarized in the "Society News" section.

Aluminum is the most plentiful metal in the world? It represents one-eighth of the earth's crust, but is so hard to extract that early costs made it prohibitive. A century ago, at $545 a pound, it was more valuable than gold. At the request of Napoleon, French scientist Deville managed to bring the cost down to $17 a pound, but Napoleon's goal of a low-cost method of production was not realized until World War II.

Several important anniversaries are coming up this year? In March the University of Missouri is having a Centennial Celebration of Engineering Education, with appropriate ceremonies slated for March 11–17. In May the American Water Works Association will celebrate its seventy-fifth anniversary.

World output of steel in 1955 set a new record? The steelmaking countries of the world produced a record total of 294 million tons of raw steel last year, 20 percent more than the 1954 world output, the American Iron and Steel Institute reports. Free World production was 224 million tons, or 76 percent of the tremendous total, more than half of it from the United States.

An unusual book on the highway situation is available? As a contribution to the highway construction program and its allied problems of traffic planning and safe driving, the Ford Motor Company (3000 Schaefer Road, Dearborn, Mich.) has prepared an "action book of things you can do to promote the program." *Freedom of the American Road* is the title of the impressive 120-page publication.

New York is getting rid of its last elevated? Demolition of the Third Avenue "El," once the city's pride, is now practically completed. Under a contract held by Lipsett, Inc., the girders, headers, and columns are cut apart by acetylene burners, then trucked to a yard on the Harlem River for final disposal to the steel mills as scrap.

A special Sanitary Engineering Issue is planned for April? The forthcoming April number of CIVIL ENGINEERING will be largely devoted to current techniques in efficient water and waste treatment.

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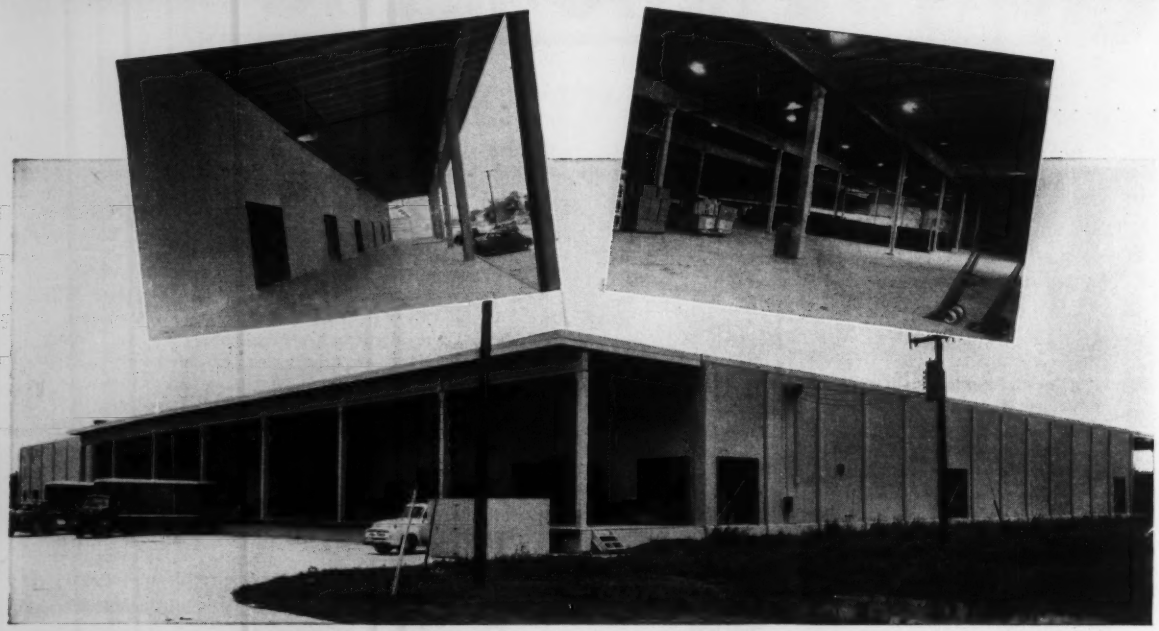

SEARS, ROEBUCK WAREHOUSE COMBINES TILT-UP AND PRECAST CONSTRUCTION FOR MAXIMUM ECONOMY

● This new warehouse for Sears, Roebuck & Company, in Jefferson Parish, Louisiana, with 77,000 sq. ft. of floor space, is prefabricated construction, one hundred percent: Tilt-up walls; precast, prestressed concrete I-shape girders, each 30 ft. x 3 ft., with 12-in. flanges; precast concrete double-T roof panels, each 30 ft. x 5 ft. x 12 in. deep.

Buildings like this go up as slick as a whistle—9500 sq. ft. of girders and roof slabs erected per day. That is the big thing about concrete prefabrication—it makes fullest effective use of every man-hour of time put against it. Manufactured to closest tolerances, for fast erection with minimum supervision, structures like this represent the most effective application of the assembly-line principle to building construction.

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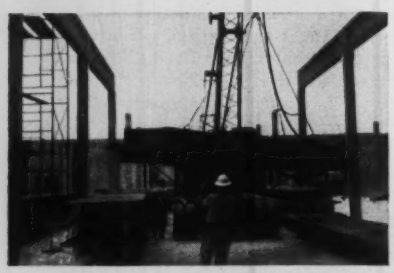

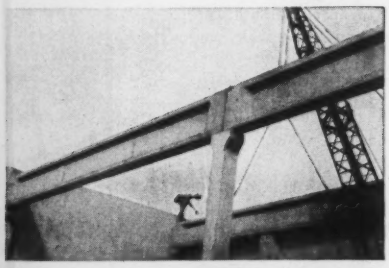

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Structural Engineer: **WALTER E. BLESSEY**

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Air view of Main Turning Basin at Corpus Christi shows bottleneck created by narrow Bascule Bridge (center foreground). All main rail and highway routes cross harbor on this bridge, which also provides passage for all vessels entering and leaving the port. Construction has just started on high-level vehicular bridge to replace this bascule.

CORPUS CHRISTI TACKLES MAJOR PORT DEVELOPMENT PROGRAM

DUANE ORR, A.M. ASCE

District Engineer, Nueces County Navigation District, Port of Corpus Christi, Tex.

One of the youngest ports in the United States, the Port of Corpus Christ (Fig. 1), was authorized by Congress in 1922 and opened to ocean traffic in 1926 From a small beginning, it has grown until it now ranks ninth among the ports of the nation.

In recent years the rapid increase in traffic, and particularly in the size of tankers operating in the Gulf of Mexico, has created a new and serious problem for both the port and the community. The Bascule Bridge at the entrance to the port (Fig. 2) acts as a bottleneck, not only because of interference between

rail and vehicular traffic over the bridge and water traffic through the bridge, but also because the narrowness of the bridge opening prevents the passage of modern tankers.

Tankers increase in size

Throughout the years since the port opened, there has been a sustained increase in tonnage except during the war years. In 1955, number of sailings had become 2,921, and total tonnage, 27,355,887, of which 92.7 percent is liquid products, including petroleum products and chemicals. The tonnage of bulk dry cargo, including grains and ores, has also increased rapidly in recent years.

Since shortly after the port opened, ship captains have complained about the narrow opening through the Bascule Bridge, and the curves in the channel approaching it. Collisions between vessels and the bridge have been frequent. Such collisions can be serious, considering how vital the bridge is to the economic life of the community. The horizontal clearance between bridge fenders is only 97 ft, while the larger tankers now coming into use have beams in excess of 82.5 ft, and some have a beam of 102 ft. Corpus Christi is thus at a competitive disadvantage with other Gulf ports, none of which are similarly restricted.

Several earlier attempts to solve the problem failed because it was not possible to satisfy one form of transportation without adversely affecting others. No problem could be more difficult to solve because of the many agencies and companies involved. The city owns the Bascule Bridge; the Navigation District owns and operates the port; and Neuces County owns and operates the Swing Barge Bridge upstream and maintains Navigation Boulevard. The State Highway Department and the U.S. Bureau of Public Roads are also involved, since state and federal highways cross the Bascule Bridge, and the Corps of Engineers is involved because this bridge crosses a navigable waterway, maintained by the Federal Government. Rail relocations affect the Southern Pacific Railroad, Missouri Pacific Railroad, Texas Mexican Railroad, and the Corpus Christi Terminal Association, which operates the belt-line railroad.

In 1950, the Chamber of Commerce took up the challenge and spearheaded the formation of a committee of civic leaders known as the "Area Development Committee," not only to solve the Bascule Bridge bottleneck, but also to prepare a 25-year master plan for the port and surrounding area. In October 1950, a nationally known firm of consulting engineers and city planners—Harland Bartholomew & Associates—was retained to prepare a comprehensive plan, and citizen committees were appointed to work with them. Reports were prepared on some 16 different phases of the problem, but this article deals only with that concerned with removal of the Bascule Bridge bottleneck.

After a careful review of the problem, the committee recommended:

1. Construction of a high-level vehicular bridge to replace the present Bascule Bridge, the new bridge to have a vertical clearance of 140 ft, and a horizontal clearance sufficient to permit dredging of a channel with a 400-ft bottom width.

2. Construction of a combination rail-highway, vertical-lift bridge across the Tule Lake Channel about $3\frac{1}{2}$ miles inland from the present Bascule Bridge,

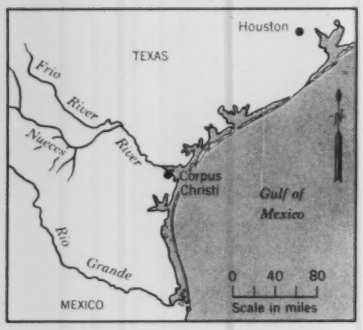
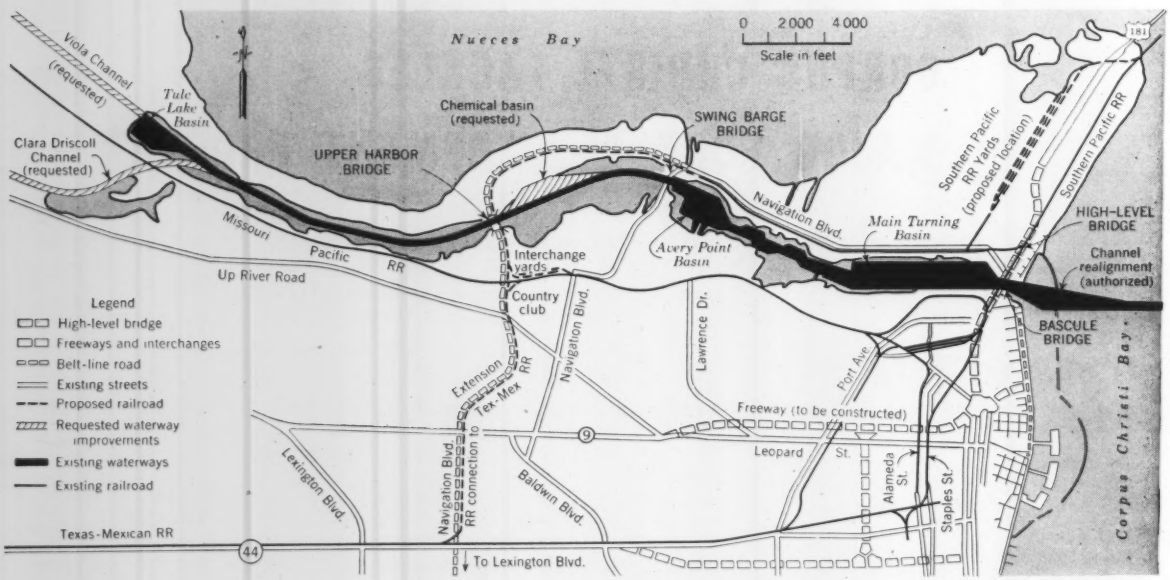


FIG. 1. Corpus Christi, Tex., ranks ninth in tonnage among nation's ports.

FIG. 2. Plan for improvement of Port of Corpus Christi includes construction of high-level vehicular bridge across entrance channel to replace narrow Bascule Bridge, and relocation of railroad tracks and Navigation Boulevard to cross harbor on new Upper Harbor Bridge.



and relocation of highways and railroads over the new bridge (called Upper Harbor Bridge).

3. Removal of the present Bascule Bridge after completion of the above work.

4. Realignment and widening of the entrance channel to 400 ft.

Upper Harbor Bridge

Construction of the combination rail and highway Upper Harbor Bridge will eliminate the need for railroad tracks over the High-Level Bridge at the entrance to the port and will also eliminate the need for the Swing Barge Bridge. The Chief of Engineers required a clearance of 300 ft between fenders for the Upper Harbor Bridge. Moving of rail connections to this bridge presents many problems and requires major railroad changes. For example, the Southern Pacific Yards, now south of the Main Turning Basin, will have to be moved north of this basin and west of U.S. 181. The old Southern Pacific right-of-way will be used for the new high-level vehicular bridge.

Corpus Christi, like most cities, has a limited number of streets that can be developed into major thoroughfares. Staples and Alameda Streets could be so developed except that both are bisected by a railroad track. The plan calls for removal of both tracks, and making these streets into thoroughfares. Delays to vehicular traffic will be further reduced by moving the interchange yards between the four railroads to a site near the Missouri Pacific mainline track and the new Upper Harbor Bridge. A number of other track changes are planned to implement the basic plan for the port.

Navigation Boulevard, the only local alternative highway route for crossing the ship channel, will be extended westward to cross this channel over the new Upper Harbor Bridge, then south to State Highway 44. (See Fig. 2.) In its new location this boulevard will connect the port with state and federal highways, and will also serve as a belt route around the city for industrial traffic.

The present Bascule Bridge across the entrance to the port is opened as many as 1,000 times a month, many openings occurring during hours of peak vehicular traffic. The new high-level bridge being constructed to eliminate these delays will have six traffic lanes, three in each direction, separated by a median strip, and emergency sidewalks. Elaborate traffic interchanges at each end will connect with the state's proposed freeways, and with state and federal highways.

In preparing the port plan, a four-lane toll tunnel was first considered instead of a free high-level bridge, because it appeared that a free facility could not be financed locally on account of the heavy commitments for other features of the Area Development Committee's 25-year program. However, the toll method of financing was dropped when the necessary legislation failed to pass the State Legislature.

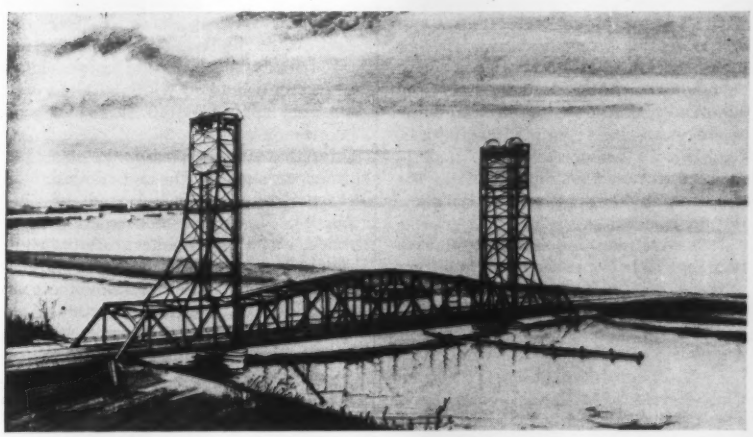
As an alternative, the State Highway Commission was requested to study the needs of the area and indicate what part of the highway program could be financed with state and federal funds. The Highway Department proposed a ten-year program including a high-level vehicular bridge over the ship channel at the entrance to the port, and a series of freeways and four-lane divided highways. This program, estimated to cost more than $50,000,000, was offered to the City of Corpus Christi and Nueces County if either or both would furnish the necessary right-of-way. (Design of the new high-level bridge is covered by Pat W. Clark, in the article that follows.)

Federal aid in financing

The Truman-Hobbs Act, passed by Congress in 1940, authorized the Federal Government to participate in the alteration, reconstruction, or relocation of railroad bridges unreasonably obstructive to navigation. In June 1952, the law was amended to include highway bridges or combination rail and highway bridges, but few bridges have been altered under this Act.

To comply with the terms of the Act, the Navigation District filed a request with the Corps of Engineers for a ruling on the Bascule Bridge at the harbor entrance, and on December 10, 1952, the District Engineer held a public hearing. Here shipping interests presented evidence that the bridge was unreasonably obstructive to navigation on the federally maintained Port Aransas–Corpus Christi Waterway. Then representatives of the City of Corpus Christi presented the Area Development Committee's plan for solving the Bascule Bridge bottleneck, involving relocation of the bridge rather than reconstruction at the present location, and requesting that the cost of relocation be apportioned under Section 13 of the Truman-Hobbs Act, by which such apportionment is based on the total cost of relocation, instead of under Section 6, which provides for apportionment on the basis of reconstruction at the same location.

The Chief of Engineers, acting for the Secretary of Defense, found the bridge to be obstructive to navigation and relocation preferable to reconstruction. However, federal participation in the relocation was limited to the cost of a bridge adequate for navigation at the present site. This would be a bridge with a single railroad track, a two-lane roadway, and one sidewalk, but with a horizontal clearance of 300 ft between fenders instead of the present 97 ft. This order made it necessary to design what has since become known as the "hypothetical bridge" for apportioning the cost of the Upper Harbor Bridge between the Federal Government and the bridge owner. The new channel alignment placed the existing railroad track and the "hypothetical bridge" on a skew, requiring a lift span 387 ft long to span the 300-ft width between fenders normal to the channel centerline required by the Corps of Engineers.



One of main features of plan for improving Port of Corpus Christi is relocation of rail crossing to new Upper Harbor Bridge. Sketch shows how this high-lift rail-highway structure will look when completed. Bids for its foundations were opened in December 1955 and completion is scheduled for 1958.

The present Bascule Bridge was designed for a Coopers E-50 loading on the railroad side, and an approximate H-15 loading plus streetcar loading on the highway side, under 1924 AREA Specifications. The live-load capacity of the existing structure was determined by using current specifications for designing the new Upper Harbor Bridge, with unit stresses having the same percentage relationship to those in the current specifications as the elastic limit of the steel used in the existing structure bears to the elastic limit of like material to be used in the new structure. The railroad design loading was found to be equivalent to a Cooper's E-58 loading, and the highway loading was found to be greater than the standard H-20 S-16. Since design loadings met minimum requirements recommended by the railroads and the Highway Department, the matter of betterments did not enter into negotiations with the Corps of Engineers in the apportionment of cost.

Under the Truman-Hobbs Act, the bridge owner bears all the costs of direct and special benefits, expected savings in maintenance costs, costs of betterments, costs attributable to increased carrying capacity, and the value of the consumed service life of the existing structure, while the Federal Government bears all other costs necessary to make the structure adequate for navigation. It was estimated that the hypothetical bridge, including approaches, less salvage of the existing bridge, would cost $4,361,492. The city's share was estimated at $33,975 for direct and special benefits, $206,268 for consumed service life of the present structure, and $36,036 for contingencies, while the Federal Government's share was estimated at $4,085,213. Local interests had to pay all costs in excess of $4,085,213, since the Chief of Engineers had limited the Federal Government's participation to its share of the cost of the hypothetical bridge. Since the relocation project, including the Upper Harbor Bridge, is estimated to cost $5,900,596, the share of local interests is $1,815,383.

Present status of project

The President in his 1955 budget message recommended an appropriation of $1,500,000 for the government's share of the cost during the first year of work, and this amount was appropriated. This year the President recommended appropriating the remainder of the Government's share of the cost. The City, County and Navigation District voted bonds for the share of local interests. Plans for the vertical-lift Upper Harbor Bridge have been prepared by Harrington & Cortelyou, Consulting Engineers, and approved by the Chief of Engineers, and bids for the piers, abutments, and fenders of this bridge were opened in December 1955. Brown & Root, with a bid of $775,370, were low bidders. Negotiations are continuing with the railroads regarding relocation of their tracks to connect with this bridge.

Bonds have been voted by Nueces County for purchasing right-of-way for the High-Level Bridge at the harbor entrance, and other projects in connection with the highway program. Plans for the High-Level Bridge have been completed by the State Highway Department, and the county is clearing the right-of-way. Agreements have been reached on the location and general plans for the interchanges and freeways at each end of this bridge, and detailed construction plans are being prepared. Bids on the foundation are expected to be received by the Highway Department in March 1956.

Thus it is seen that basic agreements regarding the plan have been reached between all the agencies involved. The Texas Highway Department is financing and constructing the High-Level Bridge over the entrance channel, the interchanges at either end of the structure, and the connecting freeways to the major highways. The City of Corpus Christi, with the aid of the County and Navigation District, is financing the local interests' share of the cost, and constructing the vertical-lift rail-highway bridge (Upper Harbor Bridge) over the Tule Lake Channel, relocating the highways and railroads to connect with it, and removing the present Bascule Bridge. The Federal Government's share of the cost of the Upper Harbor Bridge, and relocation of road and railroads, is being financed under the terms of the Truman-Hobbs Act. This is the first relocation project to be undertaken under the Act where the bridge is not to be reconstructed at the same location. The final phase of the project, dredging of a new entrance channel into the harbor, will be financed by the Federal Government and accomplished by the Corps of Engineers after the removal of the Bascule Bridge.

It is gratifying to note the rapid progress that is being made in planning for removal of the Bascule-Bridge bottleneck. It is estimated that the project can be completed by the middle of 1958. Thereafter, the largest ships operating in the Gulf can enter the Port of Corpus Christi, making it again competitive with other Gulf ports.

(This article has been prepared from the paper presented by Mr. Orr at the ASCE Dallas Convention, before the Waterways Division session presided over by Rufus W. Putnam, member of the Division's Executive Committee.)

HIGH-LEVEL

PAT W. CLARK, M. ASCE

The High-Level Bridge across the ship channel at Corpus Christi, which the Texas Highway Department intends to place under contract within the next few months, will be the largest bridge in Texas. While the span lengths are modest as compared with such structures as the San Francisco–Oakland Bay Bridge and the George Washington Bridge, the rather unusual width of roadway deck, 82 ft clear between rails, and the height of 235 ft above the water surface to high steel, place it in the category of a major structure. See Fig. 1.

The ship channel which serves the Port of Corpus Christi separates the fast-developing North Beach area from the main business section of the city. Also the two main highways entering Corpus Christi from the east and northeast cross this channel. (See preceding article by Duane Orr.) At present, the only crossing is provided by an old two-lane single-leaf bascule affording a horizontal navigation clearance of 97 ft and a vertical clearance in closed position of 10 ft. The new structure will remedy this situation by providing a generous channel width (400 ft) and a clear height of 140 ft, which will accommodate the tallest ocean-going ships that use the port.

Before starting the actual design of the structure, a thorough study of other possible types of construction was made, including an intermediate-height movable-span bridge and a tunnel under the channel. The movable span was ruled out because it would only partially relieve interference between land and water traffic, and the tunnel because it would be much more expensive both in initial cost and in operation than the high-level bridge.

Three types of construction

The new bridge will be 5,818 ft in length. Three types of construction will be used: precast, pretensioned concrete girder spans for the shorter spans, ranging from 40 to 70 ft in

CANTILEVER to span Corpus Christi ship channel

Bridge Engineer, Lockwood, Andrews & Newman, Houston, Tex.

length (Fig. 2*d*); welded-steel deck trusses for the spans ranging from 90 to 160 ft in length (Fig. 2*c*); and riveted trusses for the longest spans, which range from 270 to 620 ft (Fig. 2 *a* and *b*).

In width, the bridge will provide two three-lane roadways of 36 ft each, divided by a 4-ft median strip and flanked by a 3-ft emergency and maintenance sidewalk on each side, giving a total clear width between rails of 82 ft, which will make it one of the widest long-span bridges in the nation.

The prestressed concrete girders will be precast in lengths of 40, 60, and 70 ft. Details of the 60-ft girders are shown in Fig. 3. Essentially the construction is the same as for an ordinary steel I-beam span except that precast, prestressed concrete I-beams are used instead of steel I-beams. The beams will be cast in a casting yard, using 5,000-psi concrete. The large number of identical beams in each series will make the use of rigid metal forms feasible. After casting, each beam will be cured until the concrete has reached the required strength, and will then be post-tensioned by jacking the required tension into the prestressing elements and anchoring these elements under the required tension.

The plans permit the use of either parallel wire cables, twisted cables, or large bars as the post-tensioning elements. Each bar, cable, or group of parallel wires will be placed in a flexible metal conduit. After the prestress load has been applied and the units anchored at each end, grout will be forced into the conduits under high pressure to fill all void space and bond the prestressing steel to the concrete.

After prestressing, the beams will be handled and erected in about the same manner as steel I-beams except, of course, for their greater weight. The 40-ft beams will weigh some 7½ tons each, and the 70-ft beams, 20 tons each. The floor slab will be bonded to the beams in such a way that slab and beams will act together as a unit in carrying the live load. See Fig. 3. Comparative estimates show that the prestressed concrete spans can be built at about the same initial cost as steel I-beam spans. Economy in maintenance favors concrete as steel rusts very rapidly in this area and all steel parts must be repainted rather frequently.

The steel deck girders, which range from 90 to 160 ft in span length, are essentially built-up I-beams, formed by welding two flange plates to a web plate (Fig. 2*c*). Comparative estimates between the "stringer" type of construction, using the girders at the relatively close spacing of 8 ft 6 in., and the girder-floorbeam type of construction, using two girders per roadway, showed a very slight advantage in cost for the stringer construction. Since it had the further advantages of a greater safety factor in the event of failure in one of the girders, and of a smaller area exposed to the wind (because of the shallower girder depth), the stringer type was chosen. At this point it might be well to mention that the entire south end of the bridge, comprising all the concrete and steel girder spans south of the ship channel, lies on a 1° 45′ horizontal curve. Accordingly, simple-span designs were used in all the steel girders on the south approach to avoid the complications in fabrication, and the localized concentrations of stress, that would have been involved in continuous-span construction. On the north end of the bridge, which is on a tangent, continuous units of four- and three-span length are used.

Cantilevered truss for channel span

As will be seen in Fig. 1 and Fig. 2 (*a*), a three-span cantilevered truss is used at the channel crossing, composed of a central span 620 ft in length flanked by 310-ft anchor spans. The arched outline gives a pleasing appearance and at the same time provides a means of carrying the tremendous wind shears through the framework of the trusses down almost to the ground line. Naturally, this treatment keeps the wind bending forces on the pier bases down to reasonable levels and avoids the necessity of extremely large and expensive piers. The pattern used is also well suited to the geometrics of the channel crossing and clearance requirements. The channel passes under the bridge at a skew angle of about 20 deg. A vertical clearance of 140 ft over a width of 400 ft, measured normal to the center line of the channel, is required. The truss outline fits these requirements nicely and, in addition, places the main piers well out on the channel banks, where they are not in danger of being struck by vessels.

A further advantage of the truss pattern is that it is well proportioned for cantilever erection of the center span. Since no falsework will be permitted within the limits of the ship channel, it is anticipated that the contractor's erection procedure will be to work out from the anchor arms at each end, erecting a piece at a time until closure is made at mid-span.

The 387.5-ft central part of the channel span is a suspended, tied arch. The truss acts as the arch member while the tie is the horizontal tension member just below the floor level (Fig. 2*a*). This unit is designed to act under dead load as a statically determinate, three-hinged arch. After the floor slab has been placed and all dead load is on the structure, the bottom chord of the arch will be connected at mid-span, thereby making the unit act as a two-hinged arch under live load, with resulting increase in rigidity and reduction of live-load deflection.

Pins will be used at the lower chord joints where the arch unit is supported by the cantilever arms, thus forming hinged joints which will transmit the vertical reactions from the arch but will not transmit moment. The top-chord members above the pins will be rigidly connected during erection and will take large erection stresses. After

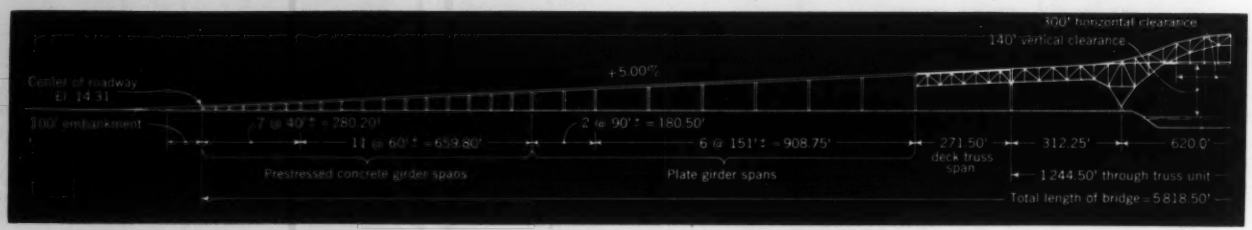


FIG. 1. Corpus Christi Ship Channel crossing consists of three-span cantilevered truss with central span 620 ft long flanked on each side by 310-ft anchor span. Unusual width

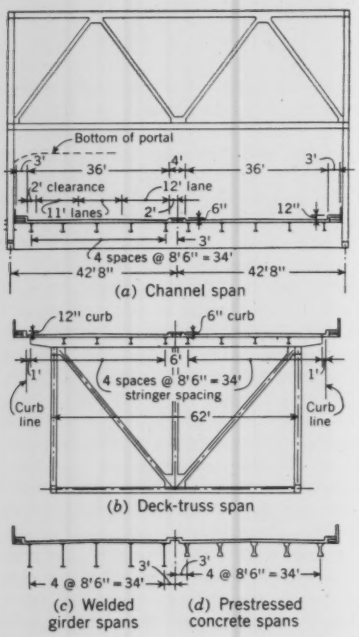


FIG. 2. Cross sections show design of channel span of Corpus Christi Bridge, (a), and three different types of construction in approach spans—(b) for spans 270 to 310 ft long, (c) for spans 90 to 160 ft long, and (d) for spans 40 to 70 ft long.

erection is completed, however, one end of these members will be disconnected and they will become idle members which could be removed without affecting the stability of the structure, but which are left in place as a matter of appearance.

The anchor spans are made of such length as to somewhat more than counterbalance the weight of the arch unit and cantilever arms, so that there will be no uplift on shoes at rest piers with full live load on the channel span.

Lightweight concrete floor slab

Lightweight concrete will be used in the floor slab of the main unit as well as on the deck trusses and the longer steel girder spans. The aggregate to be used in this lightweight concrete will be an expanded clay or shale which is produced at several different plants in Texas under the trade names of Haydite and Featherlite. A minimum compressive strength of 3,000 psi, and a maximum unit weight of about 95 lb per cu ft, will be specified. While this material will cost a few dollars per cubic yard more than regular gravel concrete, the 33-percent reduction in weight will effect savings throughout and will result in an appreciable net reduction in the cost of the bridge.

The stringers, floorbeams, and more highly stressed truss members will be of low-alloy structural steel (U.S. Steel "Man-Ten" or Bethlehem "Medium Manganese") with a working stress about 50 percent greater than that of ordinary structural steel.

The floorbeams of the channel span are unusually deep and heavy as they must span the distance of more than 85 ft center to center of trusses. These beams will be riveted plate girders of low-alloy steel, about 7 ft in depth and with flanges composed of 8-in. × 6-in. angles with 20-in. cover plates. The chord members of the suspended span are made up of plates and angles built into closed, box-shaped sections 18 in. in width and 24 in. in depth. Large hand-holes are provided in the cover plates to permit access for riveting of joints and painting of interior surfaces. The chords of the cantilever and anchor arms are to be of similar makeup, but somewhat larger—28 in. in depth and 22 in. in width. The largest chords will have a cross-sectional area of about 150 sq in. of metal. Entrance holes are provided at the truss joints so that a man can crawl from one end of the member to the other to inspect painting, riveting, etc.

Expansion shoes, interesting feature

One of the most interesting features is the design of the main expansion shoes (Fig. 4). These shoes are subject to rather large movements from wind and live-load deflection of the trusses as well as the usual temperature movements. Also, since they will be only a few feet removed from the salt water of the ship channel, a rapid rate of corrosion is to be expected unless proper preventive measures are taken. Consideration was given to placing the rollers in an oil bath, but it was feared that the proper maintenance of such devices might be overlooked in years to come. The final decision was to leave the rollers exposed to view where they could be inspected easily and not so readily forgotten.

Since the contact surfaces are practically inaccessible in so far as cleaning and painting are concerned, it appeared

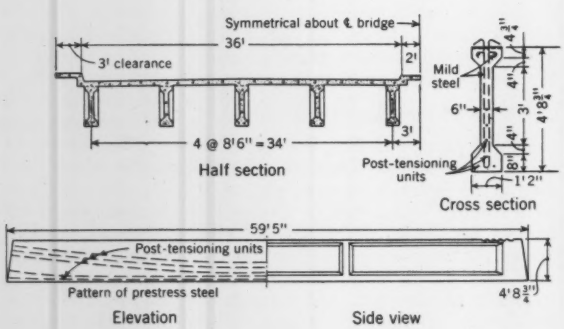
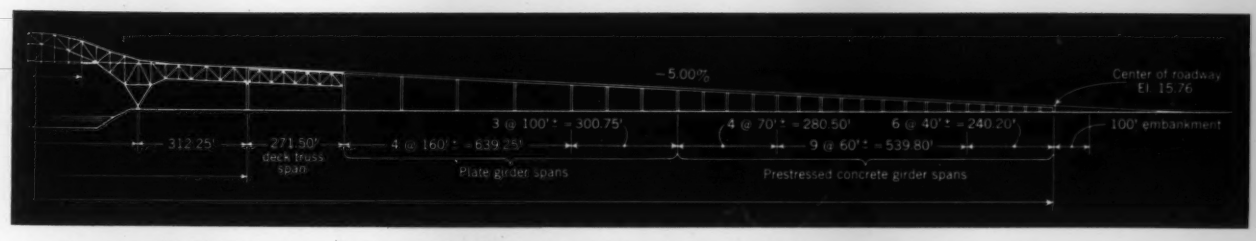


FIG. 3. Design of precast girder in 60-ft-long prestressed-concrete spans is shown in sections and elevation.



of roadway deck, 82 ft between rails, plus height of 235 ft above water surface to top steel, places this bridge in the category of a major structure. Its total length is 5,818 ft.

best to use on them a metal with a very high resistance to salt-water corrosion. The large bearing pressures further dictated that this metal be as strong as, and preferably stronger than, ordinary structural steel. Accordingly, as shown in Fig. 4, the segmental rollers and the castings on which they bear are to be faced with bars or sheets of Monel metal. The sides of the segmental rollers, which are also inaccessible but which are not subjected to high bearing pressures, are to be given a metallized protective coating of Monel.

The piers and bents are to be of reinforced concrete supported by foundation piles. Extensive soil borings and tests were made, revealing the presence of a deep layer of very soft, silty clay which starts a short distance below ground line and extends to depths as great as 55 ft below sea level. Below this soft material, rather dense strata of sand and sand-shell formations were encountered. The lengths of piles required will range from a minimum of about 50 ft to a maximum of almost 90 ft. Although the designs call for the liberal use of battered piles to transmit the heavy wind shears through the soft silts and clays to the dense sands below, stress analyses showed that the piles still will be subjected to relatively large bending stresses. The plans and specifications permit the contractor his choice of several different types of pile. Conventional precast concrete piles, prestressed concrete piles, and cast-in-place or metal-shell piles of the Armco, Helcor, Monotube, and Raymond types are all shown as alternatives.

The piers adjacent to the channel will consist of a simple but large concrete pedestal under each of the four shoes. Tops of these pedestals will project only about 5 ft above the ground. The pedestal footings will be roughly 40 ft square with some 84 foundation piles under each footing. All other piers or bents will be of the framed concrete type. Two-legged bents of the general form shown in Fig. 5 will be used throughout the higher part of the structure, with four-legged and six-legged bents in the lower sections at each end.

Live and wind loads

The structure is designed for H20-S16 loading in accordance with current AASHO Specifications. Because of its location and exposed condition, wind pressure corresponding to a wind velocity of 110 miles per hour was used in the design of all parts of the bridge. Construction material will include about 28,000 cu yd of concrete, 2,400 tons of reinforcing steel, 9,000 tons of structural steel, and 136,000 lin ft of foundation piling. The total cost of the bridge is estimated at $8,000,000.

The project will be financed by, and constructed under the supervision of the Texas Highway Department in conjunction with the U.S. Bureau of Public Roads. The cost of right-of-way, including the removal of buildings and other obstructions, is being borne by the City of Corpus Christi and Nueces County. The design and detailed plans were prepared by Texas Highway Department personnel under supervision of the writer, then Bridge Design Engineer with the Department.

The writer gratefully acknowledges the counsel and supervision of Randle B. Alexander, M. ASCE, Bridge Engineer, under whose direction the work was done; and the advice and assistance of P. V. Pennybacker, A.M. ASCE, Supervising Field Engineer, who directed the preliminary and location work on the structure. The firm of Howard, Needles, Tammen and Bergendoff acted as consultants in checking the design and details of the channel-span unit, and Richard N. Wakefield was the consulting architect on the architectural features of the structure.

(This article has been prepared from the paper presented by Mr. Clark at the ASCE Dallas Convention, before the Joint Session of the Highway and Structural Divisions presided over by Randle B. Alexander and Phil M. Ferguson, members respectively of the Highway and Structural Division's committees on session programs.)

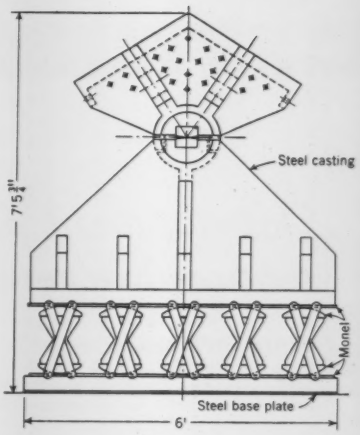


FIG. 4. One end of the channel span rests on two expansion shoes. Special design was required because of exposure to salt water and consequent danger of rapid corrosion.

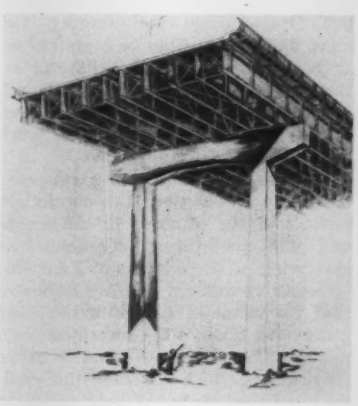


FIG. 5. Welded girder span and typical bent, seen in sketch, illustrate appearance of approach spans ranging from 90 to 160 ft in length (Fig. 2*c*). Two other types of construction are used in approach spans (Fig. 2*b* and *d*).

THREE PROFESSIONS

represented in panel on professional development

Development of professionalism among lawyers

FRANKLIN E. SPAFFORD

Spafford, Spafford, Freedman, Hamlin, Gay & Russell
Past President, Dallas Bar Association; Dallas, Tex.

The word "profession" would seem to have its origin in religion and theology. To "profess" meant to give evidence of a religious belief—to consecrate oneself to a system of belief. Thus the word "profession" has a deep and almost reverent significance. "Professionalism" encompasses the conduct, the aims, and the qualities of a profession. It bears no relationship whatever to the pursuit of material things, although in recent years "professional" has been applied to almost everyone who practices a specialized skill for pay.

Professionalism must in its true sense mean the stimulation, the encouragement, and the fostering of the higher and more noble ideals of mankind as they relate to the pursuits of a particular cultural calling. History indicates that the status of any cultural calling cannot rise above the educational level and the character and morality of its participants. This has been the yardstick by which the public has measured the legal profession in the United States since colonial days.

The organized bar of this country recognizes that high standards of legal education are essential. To make this goal effective, the American Bar Association sponsors the Association of American Law Schools, which approves only those schools that meet the high standards set by the American Bar Association. All the major law schools in this country are now members of this association and maintain its high standards. The Canons of Professional and Judicial Ethics of the American Bar Association are now the most widely recognized standard in this country.

Another agency sponsored by the Bar Association is the National Conference on Uniform State Laws, which has as its purpose elimination of the conflict and confusion often found in the laws of the 48 states due to our system of jurisdiction of state and federal governments. The American Bar Association, through the National Conference of Bar Examiners, has elevated and standardized admission to the bar in the various states. This agency also provides for investigation of each individual applicant for practice in almost every state.

The amended bankruptcy act as it now stands is largely the work of the American Bar Association, and the income-splitting and marital deduction provisions of the Revenue Code are reforms achieved largely by the American Bar Association's Section on Taxation—and so on and on. The list of the Association's achievements is long. It truly sponsors those cultural qualities which accord with the most noble traditions of a learned profession.

The State Bar of Texas is an integrated bar. All lawyers who are licensed must belong if they desire to practice in Texas. It is a quasi-state agency, having its headquarters in Austin, and is given certain statutory responsibilities in the administration of our judicial system. It is a strong organization, blessed with capable leadership and enjoys a notable history of accomplishment. Its aims are very much the same as those of the American Bar Association except that its field of operation is of course limited to the State of Texas. Almost without exception, it has sponsored every judicial reform and legislative improvement during the past fifteen years in Texas. As an integrated bar, it is only in its infancy. Relatively few state bars in the nation have achieved an integrated organization, and the State Bar of Texas is one of the strongest of these. From the donations of its members it has built a beautiful modern headquarters in Austin.

The Dallas Bar Association, with a membership of one thousand, is the strongest and best organized of the local bar associations in Texas, and one of the most effective in the nation. Its program on a local basis is consistent with, and complimentary to, both the State Bar of Texas and the American Bar Association.

The Southwestern Legal Foundation, located on the campus of Southern Methodist University, is the first of its kind in the nation. Its intensive pro-

Three professions were represented in the Panel on Aims and Attitudes of Professional Development held at the general session of ASCE's Dallas Convention. This panel, sponsored by the Society's comparatively new Department of Conditions of Practice, was presided over by Vice-President Frank L. Weaver, chairman of the Department. In this panel, the legal profession was represented by Franklin E. Spafford, the medical profession by Milford O. Rouse, and the engineering profession by G. Brooks Earnest. In the following abstracts, the contributions of these three speakers are made available to a wider audience.

gram of legal research and continuing legal education has set a pattern that will undoubtedly be followed in other sections of the country. Under the leadership of Col. R. G. Storey, Dallas, has become one of the centers of legal education in the United States. It is understandable that the State of Texas, and Dallas in particular, have been in the forefront of the work of the organized bar. Incidentally, the national convention of the American Bar Association will be held in Dallas in August of this year, and the Ninth Annual Convention of the Inter-American Bar will be held in Dallas in April of this year. The Inter-American Bar is made up of lawyers and bar associations located in North, Central and South America, as well as Canada.

America today is a nation of organizations. We as a people have developed a thinking which attaches a special significance to an organization—different from that we attach to the individuals who make up its membership. In this age of ever expanding commercial and industrial dominance, many think that the cultural life of the people will eventually be trampled under foot in the stampede for more cars, more houses, more refrigerators and the like. If those who make up professional and cultural groups do not organize effectively, their voices will be lost. As individuals they are helpless.

A society in which *all* values are based on material things is dangerous both to itself and to others. The ultimate in materialism is graphically portrayed in communism. The maintenance of a healthy balance between things cultural and things material is essential to the survival of our form of government and our way of life. I believe that the organized bar will meet this challenge by:

1. Requiring higher standards of personal character and higher standards of education for all applicants.
2. Requiring higher standards of professional conduct.
3. Perfecting a strong and aggressive national organization made up of all the lawyers in the nation, dedicated to the constant improvement of the administration of justice, the protection and preservation of our democratic processes, and the continuance of our form of government and the freedom of the individual.
4. Serving faithfully at all times as the servant of the public interest.

If to profess is to believe, then we as professionals should be believers—believers in the necessity of using our own special talents for something more than our own needs. They must be dedicated to the satisfaction of our own longing to rise above the mundane and justify our existence in the eyes of our Creator.

The medical profession and its program

MILFORD O. ROUSE, M.D., President-elect, Texas Medical Association, Dallas, Tex.

Physicians earnestly seek to acquire the rudiments of science in order to practice an art, thereby differentiating themselves from mere technicians or tradesmen. The members of the medical profession enjoy a high degree of dignity and prestige in the eyes of the public, largely because they render a very personal service, actuated by high principles of ethics (the science of morals or right conduct) rather than mere etiquette (good manners). Centuries ago Hippocrates laid down some guiding principles for physicians, which embodied the tenets of the Golden Rule, traditionally stimulating physicians to render service to humanity, with reward or financial gain as a subordinate consideration.

The economic and social changes of modern times, with many experiments in "mass medicine," pose a threat to the very close personal relationship existing between physician and patient. Doctors of medicine are keenly aware of this potential danger of diluting those fine qualities and relationships which have characterized professionalism in physicians, and for a number of years they have quietly but definitely been trying to combat such changes.

Physicians have always devoted time

freely and willingly to the instruction of young men and women who aspire to be doctors, and practicing doctors or clinicians have collaborated with full-time teachers in medical schools to inculcate in students the art as well as the science of medicine. After all, embryo physicians probably learn their greatest lessons in medical ethics through personal observations of the character, principles, and daily work of the men with whom they are associated at the bedside of patients in hospitals, and the men they later encounter in the daily practice of medicine.

In recent years increasing emphasis has been placed in medical schools on either courses or special lectures on the history of medicine and medical ethics. There is now a chapter of the Student American Medical Association on the campus of every medical school, and representatives from these chapters attend the annual sessions of the American Medical Association, as well as the annual sessions of most state medical associations. The objective is to acquaint physicians-in-training with the principles and problems that will face them daily when they are out in actual practice.

Many county medical societies, such as that in Dallas, now require an applicant to attend "orientation" sessions before he becomes eligible for membership in their professional organization. At these sessions, practicing men review the principles of ethics, the medical customs of the particular community, and the general plan and function of the county and state medical associations, as well as of the national association. The medical practitioner is the one professional man who must continue to study as long as he lives or practices, because of the never-ending progress in medicine and surgery. Professionalism is therefore advanced by the large number and variety of post-graduate avenues open to the medical man, as well as by the many excellent medical journals available to him.

Medical schools in the United States, of course, are having their financial difficulties, particularly those privately maintained, whose endowments do not bring in proportionately as much as formerly. Our national administration is incorrect, however, in a recent public statement that the medical profession is barely keeping up with the growth of the population. Actual statistics show that whereas from 1910 to 1954, the population of the United States increased 76 percent, the number of annual graduates in medicine increased 117 percent (to 6,861 medical graduates in 1954), and the student enrollment increased 125 percent (to 28,227 students in 1954). Another significant fact is that the physician of today, with better means of transportation and communication, and with more specific drugs, is able to serve many more patients than formerly, and to greatly shorten the time necessary for convalescence. In the United States there is one physician for every 730 citizens, one of the most favorable ratios in the entire world.

Another fallacy is the oft-heard allegation that medical schools refuse admission to a vast number of applicants. The fact is that in 1953 there were 7,449 admissions to medical schools from 14,678 applicants. These 14,678 applicants sent in a total of 48,556 applications to various medical schools because each student usually applies to three or four schools. The Council on Medical Education and Hospitals of the American Medical Association encourages every medical school to increase it facilities so long as it can maintain proper educational standards. In 1954 there were 28,227 students in 80 schools, whereas in 1910 there were 12,530 students in 66 schools.

The operation of medical schools is of necessity an expensive undertaking because of the personal nature of the instruction by highly trained teachers who, of course, must be paid more than teachers in other types of education. Tuition paid by the students covers only 20 percent of the total cost of maintaining medical schools. The cost of training a physician totals from

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A challenge to members of ASCE

G. BROOKS EARNEST, M. ASCE

President, Fenn College, Cleveland, Ohio

There is a common saying that history repeats itself, and this may be true, for back in January 1939, the general session of the Society's Annual Meeting included a symposium on the professional, social, and economic status of several professions. Representatives of the American Institute of Architects, American Bar Association, and American Medical Association presented what steps each organization was taking to continue to improve the "professional status" of its members. Carlton S. Proctor concluded the formal symposium with an analysis of the problem specifically relating to the civil engineering profession.

As related in 1939, the AIA for 75 years, the ABA for 60 years, and the AMA for 89 years, had been striving for mutual cooperation to promote the social welfare, the economic security, and the professional standards of their members. The engineers during this era had no single parallel organization to promote their professional status. The engineers, however, had been playing a major role in developing physical improvements most beneficial to mankind. In 1939 and previously, the members of the engineering profession lacked "status" in comparison with the members of the other learned professions, and in the eyes of many they lack that status today.

There are many types of status, but the "status" indicated here is the only kind worth having—a kind that can be conferred but cannot be commanded, that can neither be forced in growth nor synthesized from the components of a selected curriculum.

As in big league baseball, the players change from year to year, but the ground rules, by and large, remain the same. The professions represented in this panel are "big league." The ground rules have not deviated. We still abide by the service motive, the high standards of ethical conduct, a relation of confidence, a group consciousness, and a specialized body of knowledge, that is, a mental rather than a physical effort.

Ground rules relating to eligibility to practice are however confusing, for there is no conformity among the laws of the various states concerning the qualifications for a professional license to practice engineering. This is not true of the other learned professions. All learned professions stress the basic requirement of acquisition of special knowledge and skills on a high intellectual plane. One marked difference between engineering and the other learned professions lies in the degree of personal and intimate contact with clients. Except for the consulting engineer, who represents a decided minority

$10,000 to $12,000, yet the student's total four-year tuition averages only $2,532. Gifts, grants, endowment income, and appropriations from taxes make up this large difference in the cost of maintenance.

Federal subsidy not wanted

American physicians feel that the financial support of medical education should come from physicians themselves, from industry, and from other public-spirited citizens, rather than from federal subsidies. Such subsidies would bring inevitable encroachment in the form of bureaucratic direction of medical education. In the past three years, through the American Medical Education Foundation, physicians and their wives have contributed additional support to medical schools in the amount of $4,500,000, while the National Fund for Medical Education has raised an equivalent amount from industry and from laymen. Last November the Commonwealth Foundation made a generous gift of $7,100,000 to a number of medical schools in this country, and now the Ford Foundation has announced its intention to give $90,000,000 to our privately supported medical schools.

High professional standards among graduates in medicine have been maintained largely because of private enterprise, and diligent and faithful work by faculties and sustaining groups. As has been said quite truly, "Big government makes little people!" Sad indeed will be the day when our medical schools are compelled to turn to the Federal Government for adequate support. Up to now the medical profession has resisted successfully all direct and side-door attempts to include them in the Social Security taxation system. Physicians invite members of all professions to join with them in popularizing study by all citizens of the true status of the federal Social Security System. Such a study will point up the real insecurity of the payroll taxation system which has developed so insidiously in the past 18 years. There is still time if all professions act vigorously together. Professionalism may truly hang in the balance.

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in the profession, the majority of engineers are employees and therefore not free to fulfill the ethical responsibilities of their profession.

It is admitted that the national technical and professional societies have a real stake in the development and maintenance of engineering as a profession. Societies are composed of members. This puts the problem on the doorstep of each individual member, regardless of field or specialty.

Let us now look at the challenge facing each one of us in ASCE. Civil engineering, undoubtedly more than any other branch of engineering, covers a wide span of professional activities. It is difficult to determine in a number of these activities where the subprofessional or preprofessional or technician classification breaks off, and where the professional classification begins. We appreciate that sub- or preprofessional duties may be considered as stepping-stones toward the professional goal, but it behooves us to make a clear-cut division between the two standards and define the point where this division occurs. This may be the crux of the whole problem facing the engineering profession today. The lay public sees a man performing a field survey, or hears of someone working at a drafting board or in a laboratory and immediately calls him an engineer, whereas he may actually be performing a perfunctory assignment merely for his livelihood, with no aim toward self-development.

There are too many trying to get into the act who are wrongly classified as engineers by those who have no understanding of what makes one a member of the engineering profession. We are faced with either a long-drawn-out program of educating the public, or an immediate powerful effort. The latter would lighten the missionary burden by bringing positive action at once. The former may take years of effort, and may encounter negative factors eventually calling for considerably more educational effort than now presumed.

The bull-by-the-horns tactics may be the best in the long run, but as in any mutual comprehensive development in any profession, there must be coordination. ASCE cannot stand alone in this venture; it needs the support and cooperation of other engineering societies. Here is a task of a herculean magnitude for EJC, but EJC must be convinced that the problem is of substantial proportions and that there is a genuine need for coordinated endeavor.

One of the components of eligibility to the learned professions is education. The medical and legal professions require a pre-med and pre-law basic schooling before enrollment in a college for professional education. The question whether an engineer can obtain sufficient pre-engineering and professional education in four years is being answered by the five-year programs being adopted, as well as the inauguration of many binary programs where a student obtains pre-engineering training in a liberal arts college and professional education in one of the institutes of technology. The lay public would be better able to envisage engineering as a profession if its grass roots—that is, undergraduate education—came closer to the requirements in the other learned professions.

A second component of eligibility lies in the state registration laws. The technical and professional engineering societies should exert a coordinated effort to have enacted in every state in the Union a uniform law for the registration of engineers equivalent to that found in those states with the highest standards for attainment of a license to practice in the profession.

Now, providing that all the requirements for eligibility to practice engineering are met so that it is placed on a par in this respect with the other learned professions, or nearly so, the greatest challenge still confronts the engineering profession in carrying out within its own ranks a separation of the eligible from the non-eligible. The problem resolves itself into: (1) a definition of the term "engineering profession," and (2) an all-out educational program to make the public aware of the sharp dividing line between the subprofessional or technician status and the professional status. The Taft-Hartley Act gives a generally accepted definition of the "engineer" as a professional. The educational program under (2) must emanate from an organization or group of organizations.

EJC together with NSPE would be the natural agencies to co-sponsor a nationwide barrage to secure for the profession of engineering the status it justly deserves. In the meantime, and until a concentrated effort can be organized, it behooves each member of ASCE and each member of other technical and professional societies to help educate the public to discriminate between the subprofessional or technician, and the professional engineer. The challenge is yours and mine. May each of us assume our obligation with our goal the raising of the engineering profession to a seat of honor on the dais along with the other learned professions.

PLASTICS

—new and promising building materials

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The present importance of plastics in building is largely based on non-structural and auxiliary uses, but there is growing interest in structural and semi-structural uses. It is estimated that in 1955 some half-billion-dollars worth of plastics were used in construction. Classes of plastics here described all find at least some use in buildings, and many of these uses are expanding rapidly.

As auxiliaries to other materials

Adhesives and coatings are the two principal building uses of plastics as auxiliaries to other materials. Synthetic resin adhesives account for some 170,000,000 lb of plastics annually. A large part of this is used in plywood, the phenomenal growth of which is mainly attributable to the advent of reliable waterproof synthetic resin adhesives. Reliable plywood in turn has led to a rapid expansion of lightweight, strong and rigid stressed-skin construction, especially in housing. Metal-to-metal bonding with high-strength resin adhesives is becoming increasingly common, as for example in fabricating aluminum-alloy and stainless-steel aircraft. This application is finding increasing use in metal building panels.

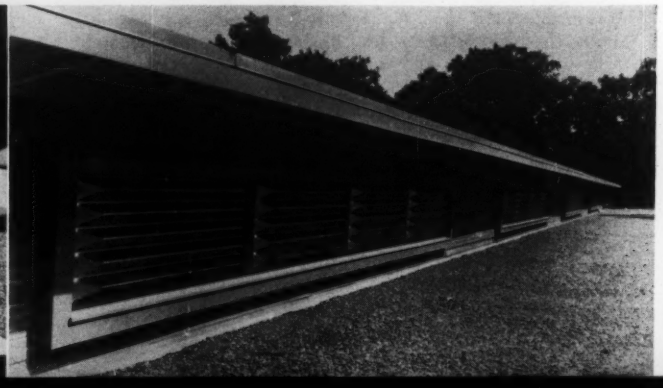
Coatings, both protective and decorative, have undergone marked improvement as synthetic resins have entered this field. The traditional drying oil vehicles have been greatly altered; durability under a wide variety of conditions has been markedly improved; hardening has been accelerated; and color ranges increased. Development is still going on. For example, water-based emulsions of acrylic, vinyls, polystyrene and other plastics show great promise.

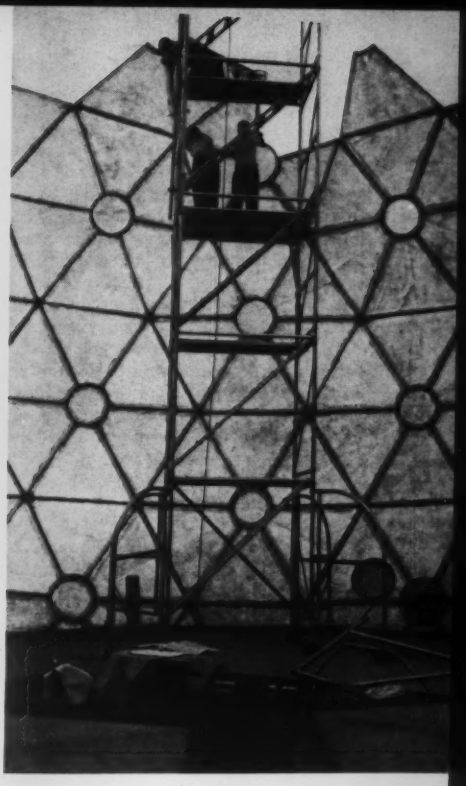
Non-structural uses of plastics

Non-structural uses of plastics in construction are rapidly increasing, and some of the most important will be discussed.

Laminated panels. Wood veneer decorative printed paper or fabric is overlaid with transparent melamine formaldehyde and underlaid with a phenol-formaldehyde impregnated

Skylights of acrylic are made strong by shaping into domes or bubbles (below left). For sidewall lighting (below right), acrylic sheets can be given horizontal triangular corrugations, with skyward side opaque to cut sun glare, and downward side transparent to admit maximum amount of reflected light. Plexiglas skylights in Norman High School, Norman, Okla., were made by Plastic Engineering Co., Tulsa, Okla. Plexiglas louver panels are in sidewall of Katherine Smith School, Houston, Tex.





Domed structure for M. I. T. Lincoln Laboratories is made up of ribbed polyester panels, reinforced with glass fiber. This type of structure, developed to house military electronic equipment, utilizes the high strength-to-weight ratio of plastic material. Non-metallic character of material, good light transmission, and unobstructed interior are advantages in projected use.

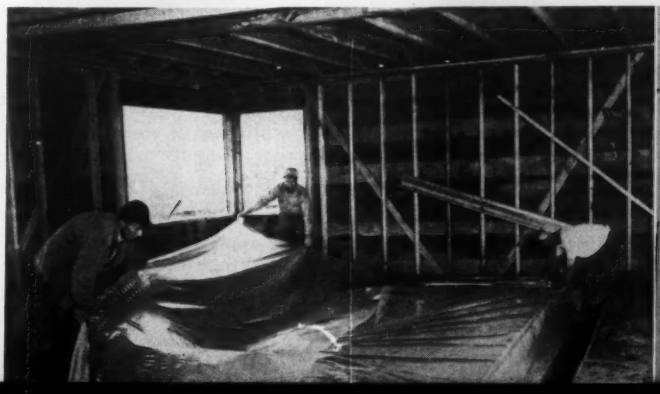
kraft paper. When cured and fused together in a hot-plate press at high pressures, the resulting board is hard and strong, and has a highly decorative surface resistant to wear, water, and commonly-found solvents. It is resistant to cigarette burns if aluminum foil is incorporated to carry away the heat. This laminate is widely used for table tops, counters, and wall surfacing.

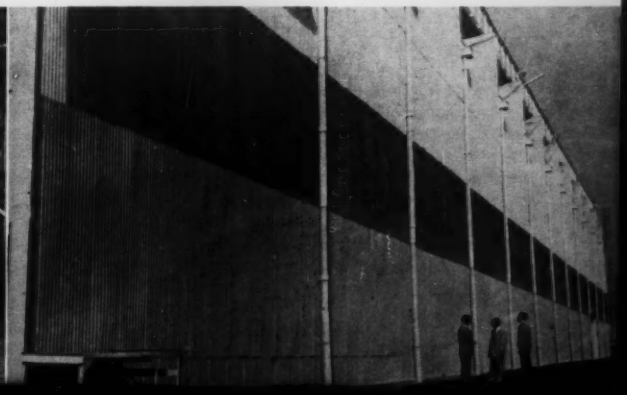
Flexible wall coverings. Flexible vinyl chloride sheet and sprayed-on vinyl chloride are both used as wall covering. Flexible sheet may be figured and colored. Felted backing provides a good grip for the adhesive. Sprayed vinyl chloride is applied directly to walls or other surfaces, and may be clear or pigmented. The quality of the bond between sheet or sprayed material and the wall is important. Some calendered or rolled sheet stocks if not prerelaxed may tend to retract with time, and if the adhesive has insufficient gripping power, the edges of adjoining sheets may pull away from each other. Vinyl surfaces are tough and scuff-resistant, especially useful where wear and tear are severe.

Floor coverings. The toughness and abrasion resistance of vinyl chloride has made it a favorite for floor covering in sheet or tile form. Texture and hardness are largely controlled by the amount and type of filler, such as asbestos fiber. The higher the filler content the harder, less flexible, more resistant to denting and more resistant to flow the floor covering becomes. All the usual formulations are tough and wear resistant, and possess wide ranges of color and figure possibilities—qualities which have contributed to their rapidly expanding use as flooring materials.

Illumination. Transparent and translucent resins, both thermoplastic and thermosetting, find extensive use in illumination. Especially noteworthy are the overall luminous ceilings found in commercial and industrial establishments. Acrylic, vinyl chloride, polystyrene, and reinforced polyesters in corrugated, coffered or

Two promising building uses of plastics are illustrated. Below left, polyethylene film is employed for moisture barrier under floor slab. Workmen place Visqueen film over sand base to protect it from sharp projections. Below right, corrugated glass-fiber-reinforced panels of Alsynite provide sidewall lighting for Douglas Aircraft Company's El Segundo, Calif., plant. These panels are designed for use with corrugated metal siding, nesting with it and fastening in same manner.





otherwise stiffened sheets provide lightweight diffusing materials. The space above the ceiling is often used to carry pipes, ducts, and other service lines. Large diffusing shades are becoming a feature of street-lighting systems. The simple process of vacuum forming provides deep coffered breakage-resistant shades.

In sidewall lighting, acrylic sheets can be given horizontal triangular corrugations, with the skyward side of each triangular rib made opaque or diffuse to cut the direct glare of the sun, and the downward side left transparent to admit diffuse sky or earth-reflected light.

Piping and ducts. Corrosion resistance, flexibility, and lightness may make plastics useful for piping and ducts. Cold-water lines of polyethylene are rapidly becoming standard for water service from street mains to dwellings. Sprinkler lines for lawns and golf courses are made of polyethylene and cellulosics. Cellulosics are used to handle corrosive crude oil and have found use in gas lines. Reinforced plastic pipe is used where pressures are too great for unreinforced plastics. Rigid polyvinyl chloride pipe and fittings are available, particularly to handle corrosive liquids. Vinylidene chloride-lined steel pipe is available. Where corrosion is especially severe, as in handling hot fluorides, the fluorinated plastics such as tetrafluoroethylene and trifluorochloroethylene are especially useful. Similarly, ducts carrying corrosive fumes, when made of rigid polyvinyl chloride, have outlasted metal ducts many times.

Precautions must be taken—especially when thermoplastics are used for piping and ducts at higher temperatures. Thermoplastics soften as they become warmer. Ducts must therefore be adequately supported, and pressures in piping must be kept low enough to avoid excessive creep leading to bulging and failure, or the plastic must be restrained against creep. Polyethylene tubing buried in concrete, for example, has been used both for brine lines in ice-skating rinks and for radiant heating. In both applications its flexibility simplifies the original installation.

Foams. Many plastics can be foamed, some in the factory, others in situ. Among the former are polystyrene and cellulose acetate. Both have found use as insulation and as cores of structural sandwiches. The low water absorption of polystyrene, and the fact that the air cells are not interconnected, makes for low vapor transmission. Such foams have been used on roofs and sidewalls, and as overall or perimeter insulation in slab-on-ground construction. Foamed-in-place plastics include polystyrene, phenolics, and the new polyisocyanates. These are formulated as liquids, poured into the desired space, and allowed to expand. For irregular, hard-to-reach spaces they are promising.

Films. Films are among the largest tonnage products in plastics. In building, their principal use until recently has been as shower curtains and as translucent tarpaulin materials. With the advent of slab-on-ground construction, with its need for vapor barriers under the concrete, and with the growing need for vapor barriers generally in insulated walls and roofs, use has been made of plastic film such as polyethylene and vinyl chloride.

Structural and semi-structural uses

Structural and semi-structural uses of plastics have recently become the focus of a great deal of development activity. Because most plastics are by themselves too weak or too brittle, attention is centered on the composites in which high-strength fibers are embedded in resin binders. These include the high-pressure laminates and the so-called reinforced plastics in which the resins are polyesters, epoxies, and others requiring little or no pressure and only moderate or room temperatures to cure.

Although many fibers are extremely strong, the one almost exclusively employed in high-strength composites is glass, drawn into filaments a few ten-thousandths of an inch in diameter. Of the various fibers, only glass has a high enough modulus of elasticity, approximately 10,000,000 psi, to provide the necessary stiffness as well as strength.

Commercial glass fibers have strengths in the order of 250,000 to 400,000 psi. When carefully aligned, compacted in bundles, and impregnated with just enough resin to bind the fibers together, glass fiber-resin rods have been produced with strength exceeding 250,000 psi. In practice, glass fibers are woven into a variety of fabrics, or they are formed into rods like fishing rods, or most commonly, are chopped into short lengths for mats. Depending on the relative ratios of glass and resin, and the form of the finished product, strengths may vary from the high value of 250,000 psi for carefully made rods as mentioned above, to low values of perhaps 10,000 to 15,000 psi for mat-reinforced sheets. Moduli of elasticity may range from about 6,000,000 psi for rod and unidirectional sheet, to 1,000,000 psi for mat-reinforced sheet.

Principal structural and semistructural applications of reinforced plastics in building have been corrugated sheet and facings for structural sandwiches.

Corrugated sheet is translucent and tough, highly resistant to shattering under rough usage. When made with standard corrugations, it is easily installed with cement-asbestos or metal corrugated sheets for skylights and side lighting without requiring special framing.

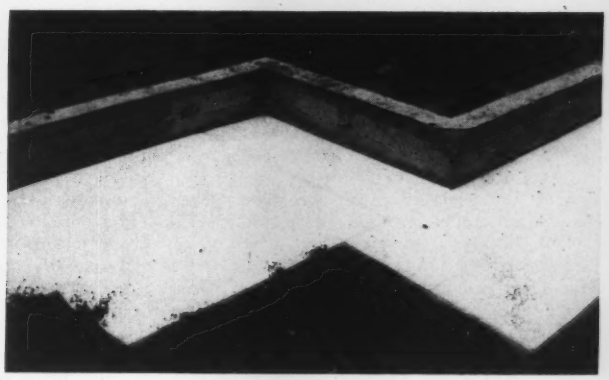
Structural sandwiches consisting of facings of high-strength, dense materials bonded to low-density cores to provide strong, rigid, lightweight panels, are gaining favor in buildings, especially as curtain walls. Reinforced plastics in sheet form have been incorporated as facings into sandwiches with a variety of cores such as foamed plastic, honeycombs made of resin-impregnated kraft paper, and grids of wood or aluminum. When the core is not opaque, the sandwich may transmit a considerable amount of light. Structural sandwiches are also made with opaque facings and cores for decorative effects.

Domes. Corrugated and sandwich panels are semi-structural and fit into more or less conventional structures. Perhaps more significant and revealing are the reinforced plastic dome-shaped shelters up to 55 ft in diameter recently developed for military purposes. These shelters must house electronic equipment and be essentially transparent to electromagnetic radiation. Consequently they must be of non-metallic materials; they must be completely unobstructed inside; and they are exposed to temperatures ranging from −60 deg F to 180 deg F with winds as high as 150 mph. Such shelters, built of light ribbed reinforced plastics sections incorporating glass fiber mats and fabric, have successfully withstood the imposed conditions. They have proved to be remarkably rigid and so light that they can be easily transported by air.

These shelters take advantage of the ready formability of plastics to provide efficient structural forms; they utilize the high strength-to-weight ratio possible; and they overcome the inherent low stiffness of the material by utilizing an inherently stiff shape.

Major trends favor plastics

Any attempt to forecast future trends in the applications of plastics to building must take into account the



Polystyrene foam boards, by Dow, are utilized as perimeter insulation on a roof.

major trends in the building field, the developments in plastics, and the questions, many still unanswered, associated with the introduction of these relatively new materials among the established traditional materials of construction.

In the building field we find several major trends:

1. Increasing use of shop-fabricated units assembled at the site, with minimum field labor in minimum time. Field labor is expensive, and carrying charges on building sites and unfinished buildings are high.

2. The demand for large clear spaces, unobstructed by interior supports such as columns, providing maximum flexibility in space arrangement. Arches, vaults, domes, slabs, hipped plates, long-span trusses, deep girders, and space frames all play a part.

3. The tendency to use light-transmitting exterior walls and roofs to admit maximum daylight. Associated with this is the trend toward curtain walls.

4. The greatly increased importance of mechanical and electrical equipment. In industrial buildings, in particular, the cost of such equipment may easily absorb half the total building budget. Part of this is associated with the demand for complete flexibility in arrangement of space which requires electrical power, air conditioning, and overall illumination to be available everywhere.

Plastics can play a part in promoting all of these trends. For example, space structures of ribbed concrete, steel, or timber might well employ skins of shaped plastics between the ribs. If these skins were shaped into domed bubbles, coffers, sandwiches

Plastic wall panels provide fine interior finishes. South Coontys Gas Co. Building, Los Angeles, utilizes Parkwood Genuwood walls in gum pattern, a decorative high-pressure laminate Witty wood-veneer product.

St. Cloud (Minn.) Hospital has Boltawall installation in bamboo pattern, a flexible vinyl chloride.

and other stiff, strong shapes, a combination capable of spanning long distances could result.

Developments in plastics are many and it is manifestly impossible to consider them all. Among those of possible significance in building are:

Copolymers. If a basic plastic does not have quite the properties desired, it is often possible to build other units into its molecular structure to modify its properties. By copolymerization and by the incorporation of fillers, stabilizers and other additives, an almost infinite range of properties can be achieved within the maximum limits of the material.

Reinforcing and laminating. Improvements in the high-strength composites are continually being made. Better methods of fabrication to provide sounder, denser products are being developed. Greater durability and resistance to attack by fire are constantly being sought.

Increased durability. The fluorinated resins and the silicones appear to be particularly promising. They demonstrate remarkable inertness over a wide range of temperatures and under extremely severe corrosive conditions.

Cost. Compared with wood, concrete, and structural steel, the per pound cost of plastics is generally high. As volume increases, costs are decreasing, and the materials become increasingly competitive. Nevertheless, cost is still a decided deterrent, especially among the most durable plastics such as the silicones and fluorinated plastics. Each pound must be designed to do its utmost if it is to compete with lower-cost materials.

Problems to be solved

Many of the problems associated with plastics involve time and temperature to a greater degree than is true of traditional building materials. Other problems involve unfamiliarity on the part of designers, who must learn new properties and limitations and the design procedures necessitated by them.

From the structural standpoint, one of the principal problems is inherently low stiffness. Moduli of elasticity of many unreinforced plastics are less than 500,000 psi, and for such flexible materials as polyethylene and plasticized vinyl chloride, are much less. Even the best reinforced and laminated composites rank well below aluminum. It is essential therefore to employ shapes that are inherently stiff, such as corrugations, ribs, sandwiches, coffers, arches, domes and similar shapes.

Associated with low stiffness are the factors of creep and relaxation under continuous load or deformation. This is particularly true of thermoplastics, especially under warm conditions. Stress intensities may have to be kept low or a structure may need frequent supports to prevent bulging or sagging. These disadvantages must be offset by advantages, such as corrosion resistance, to justify use of plastics.

Many plastics exhibit higher expansion and contraction with changes in temperature than do traditional materials like metal and glass. Where plastics are used in conjunction with other materials, allowance must be made for differential expansion and contraction by such devices as slip joints or by forming the plastic into corrugations, U-shapes, and other forms capable of allowing for movement. The readiness with which plastics can be formed often helps. For example, flexible tubing can be laid in a snaky pattern instead of straight.

Many of the large-volume plastics in use today do not have a history of exposure to deteriorating influences, especially weathering, of long enough duration to permit accurate predictions. While a great many plastics can be expected to last the life of the building indoors, relatively few have long exposure histories outdoors.

Among the plastics with long outdoor exposure histories are the acrylics, phenolics, and melamines. Properly formulated and fabricated these materials should give good accounts of themselves. Vinyls, especially when pigmented with such materials as carbon black to exclude the actinic rays of the sun, appear to be promising on the basis of exposures of between ten and fifteen years. The fluorinated plastics and the silicones appear especially promising under the severest conditions. Some transparent plastics turn yellow or darken in sunlight but may otherwise be satisfactory. Others when buried in the ground or otherwise protected from the sun and extreme temperature changes have given good accounts of themselves. The volume of experience data is growing every year, but it will still be some time before long-time records of exposure are complete.

Any plastic can be destroyed by fire. Some burn unaided when combustion has started, others smolder, still others will not support their own combustion. A few burn briskly; a few, especially nitrogen and fluorine-containing types, give off noxious or even dangerous products of combustion, but most give off gases comparable to those of burning wood and paper.

Engineering design

The high-strength composites, that is, reinforced plastics and high-pressure laminates, may be isotropic or they may be highly directional or anisotropic in their mechanical properties. Herein lies one of their potential advantages. Because the fibrous reinforcing material can be arranged at will, it is possible to tailor the strength properties to suit the stress conditions, thereby achieving maximum efficiency in the use of fiber and resin. At the same time, careful analysis of stresses is required because it is not sufficient to determine maximum stresses, make sure they are met, and assume that all other stresses are automatically on the safe side.

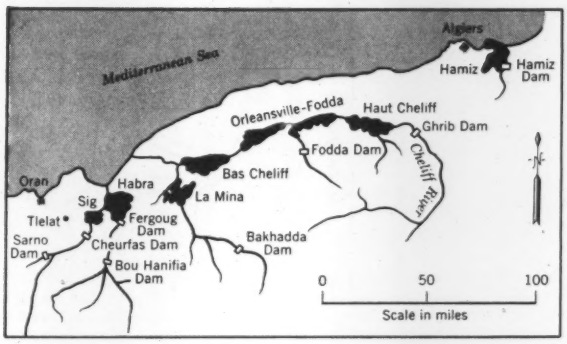
When the strength of a material can be varied with direction, it must be checked against stresses which also vary with direction to make sure that strength is balanced against stress. In this respect the problem is analogous to reinforced concrete design. Furthermore, with anisotropic materials, the simple theory of elastic isotropic behavior is inadequate and the more sophisticated theory of anisotropic elasticity is needed. Fortunately, because of the right-angled structure of fabric reinforcement, these composites are usually orthotropic or, at least, the individual layers are orthotropic, and the corresponding theory of orthotropic materials can be employed.

Much still needs to be learned of the strength properties of composites. This is particularly true of their behavior under combined stress, especially in composites consisting of orthotropic layers oriented in any arbitrary manner with respect to each other. Hypotheses of strength still need to be checked and revised by experiment.

Plastics are already quite strongly in the building picture. It is of course speculation to attempt to assess their future role. It should be evident, however, that here is a new group of materials possessing certain desirable characteristics and also possessing limitations. As is true of any material, successful use involves taking advantage of the desirable attributes and circumventing the drawbacks.

(This article was originally presented by Mr. Dietz as a paper at the ASCE Dallas Convention, before the first session on plastics to be sponsored by a Technical Division of the Society. This session of the Engineering Mechanics Division was presided over by Mr. Dietz as chairman of the Division's Plastics Committee.)

Typical section of irrigation pipe is prefabricated, and prestressed both transversely and circumferentially. →



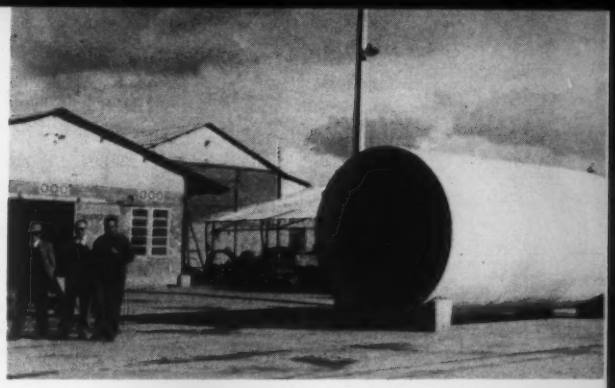


FIG. 1. Eight irrigation projects in Northwest Algeria cover irrigable area of 222,000 acres, half of which was actually irrigated in 1952, year before author's trip by car from Algiers to Oran and return. Principal dams are also shown.

Irrigation systems in Algeria designed to save water and labor

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Irrigation problems in Algeria are much the same as those in the United States. Contrary to popular opinion in America, a considerable part of Algeria, particularly along the Mediterranean Coast, is no more desert than, for example, California. In this part of the country the average annual rainfall varies from 6 to 14 in. on the high plains lying between the coastal and interior mountain ranges, and up to 40 in. or more in the mountains near the eastern boundary. As in our own West, average rainfall rates mean little in terms of the production of most crops.

Irrigation has been practiced in parts of Algeria from very ancient times. Evidence of extensive farming during the days of Imperial Rome still exists, and air photos clearly show the land-use pattern of those days. After the expulsion of the Romans, agriculture disappeared except for date groves in the oases. Later, when irrigation again became important, more or less primitive systems were developed. Within the past few decades the French have been greatly expanding and improving the old projects. The expansion is based on the storage of water behind major dams.

The writer visited several of the major irrigation projects in Northwestern Algeria late in 1953 during a trip by car from Algiers to Oran and return. The major irrigation projects are in or adjacent to the valley of the Cheliff River, between the coastal hills and the Saharan Atlas Mountains (Fig. 1).

All but one (the Fergoug) of the dams shown are for storage, and the reservoirs have a total capacity of 550,000 acre-ft. The Fergoug and Cheurfas Dams have been repaired and strengthened; the Hamiz has been enlarged; and the others have been constructed since the new irrigation program was started in 1926. The Fodda is a straight gravity concrete structure; the Sarno is an earth fill; and the others are of massive dry stone masonry with impermeable upstream faces of bituminous or concrete type.

The eight projects shown in Fig. 1 cover an irrigable area of 222,000 acres, of which almost exactly half was actually irrigated in 1952. The total investment in these projects, excluding the storage reservoirs, amounted at the end of 1952 to 10,011,000,000 French francs or $28,600,000, at the rate of exchange at that time. Construction was still in progress in late 1953.

The crops grown in 1952 were, in percentage of irrigated area: citrus fruits, 21; cereals, 20; truck crops, 29; other fruits, 11; cotton, 8; and miscellaneous, 20. Because more than one crop was grown on some land, these percentages total more than 100. The average quantity of water delivered at the farm takeouts amounted to 1.8 acre-ft per acre. The small quantity required was, at least in part, due to an unusually wet season.

Generally typical of Algerian irrigation systems is the Hamiz Project (Fig. 2), which has an irrigable area of 37,000 acres, of which 14,000 were irrigated in 1952.

As everywhere in arid and semiarid regions, the need for water is approaching the available supply more and more closely, and labor costs for maintenance and operation are steadily rising. For these reasons the new systems have been designed to save water and labor wherever possible.

Algerian irrigation systems present many thought-provoking aspects to the American engineer. Design and construction of their newer projects differ greatly from those to which we are accustomed. In areas of low relief, open channels are used in both countries. In America flumes are used only where excavated earth canals are more or less

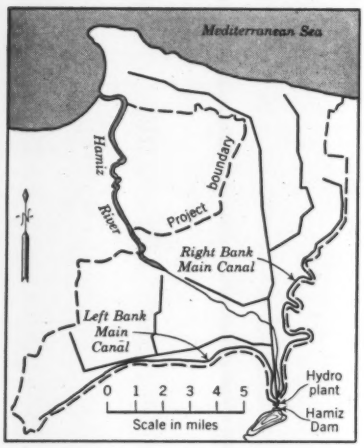
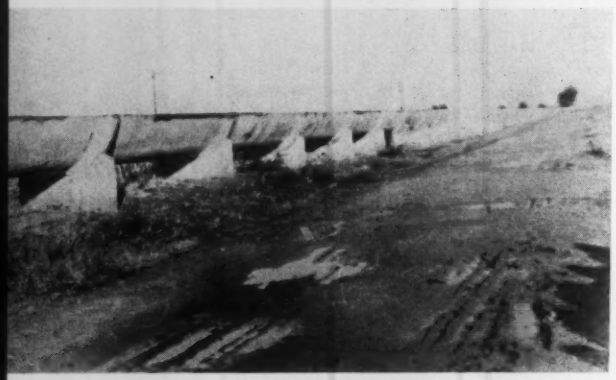


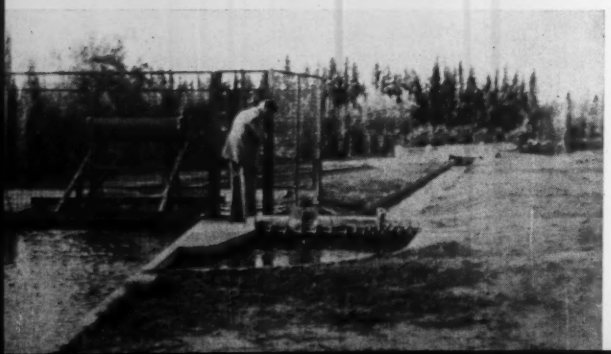
FIG. 2. Hamiz Project, typical Algerian irrigation system, has two main gravity canals—Left Bank and Right Bank—and secondary conduits as indicated.

Irrigation lateral of prefabricated and prestressed units runs along public highway in Algeria. Flumes generally follow road or property lines to avoid right-of-way problems. Elevated flume also eliminates need for structures to carry cross drainage except at major stream crossings.



Long V-shaped weirs are built into flumes to maintain constant levels upstream.

An upstream constant-level gate and a set of constant-flow orifices together provide uniform flow in an Algerian lateral.



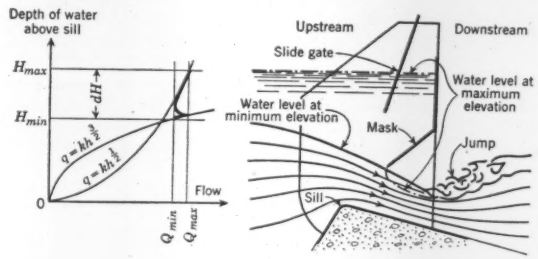
impossible, whereas in Algeria the channels consist entirely of concrete flumes. Earth canals, especially the smaller ones, necessarily follow the meanderings of the grade line on the ground. Flumes, on the contrary, can be built on much straighter lines, cutting out many curves and flattening others. While the Algerian flume lines occasionally cut through ridges, as a rule the water level is so high above the ground surface that the flume sections are mounted on piers of various heights.

The principal advantages of this method are: (1) There is no need, except at major stream channels, for under- or overpass structures for cross drainage; (2) canals and laterals are not blocked by sediment carried into them from the upper side during heavy runoff from rain or irrigation; (3) there is no canal-bank erosion, with its attendant problem of bed deposits; (4) there are no important weed or rodent control problems; (5) there is no seepage loss, and leaks are easily detected; (6) the permissible loss of elevation of the water surface is more adequate for control, measurement, and application of water on farm lands, thus permitting the use of land right up to the right-of-way; (7) canals can be shorter, since the contours need not be followed so closely; and (8) right-of-way problems are reduced, since in most cases flumes follow road or property lines.

On the thousands of feet of elevated canal and lateral structures observed, only a few leaks were seen. These were on one of the first systems of this type installed and were harmless. One reason for the lack of leaks appears to be the fact that each length of flume is built of prestressed concrete.

In areas of considerable relief in

FIG. 3. Constant-flow orifices used in Algerian laterals take advantage of the fact that head vs. discharge relations are different for weirs and for orifices. Curves, left, illustrate principle involved, and longitudinal section, right, shows arrangement of constant-flow orifice.



Algeria, even where the slopes are comparatively smooth, irrigation water is distributed through closed pipe systems. Both flumes and pipes are made up of units prefabricated at centrally located plants and trucked to final location. These units are made of high-grade prestressed concrete. Often the piers as well as the flume sections are prefabricated.

Automatic flow-control devices have been developed to reduce the cost of operation, both in water losses and in labor requirements. The ultimate goal is a transmission and distribution system which operates completely automatically from the opening or closing of a farmer's headgate back through the network to the necessary adjustment in the discharge valve at the reservoir or the starting or stopping of a pump. This ideal project would work like a fully automatic electric power system. The farmer himself would open his gate, and his supply would flow through peak-limiting or peak-recording and volume meters. When he closed his gate, the resulting changes in flow would activate the controls all the way back through the system. So far, in the Algerian operations, the farm delivery gates are operated by project personnel, and few recording meters are used. Most of the irrigation water is so dirty that presently available meters do not function properly, but new designs are still being tested. In the closed-pipe systems, completely automatic control already has been worked out on paper and, at least in some instances, nearly if not quite so in practice.

Closed-pipe systems fed directly from a reservoir or a stream with an excess of supply are comparatively simple. All the pipes are designed to withstand the static head created by the reservoir or the diversion dam, and of sufficient capacity to meet the maximum demand. The ordinary small municipal waterworks are of this type. Where the static head becomes too great for convenient operation, "pressure breakers" and small regulating basins are used. An interesting piece of equipment for automatically governing the flow from the supply line into such a regulating basin consists essentially of a nozzle discharging vertically upward and closed by a self-centering disk controlled by a float. Such devices are made in standard sizes with nozzles about 1.25, 2, 3, and 5 in. in diameter and capacities up to 10 cfs, with a maximum head of 328 ft. Larger sizes are made to order. They will hold the water level in the regulating basin constant, and thus the static head on the system fed therefrom, within narrow limits. This idea for controlling the head on a system is not new. The advantage of the device is its extreme simplicity. Because little or no irrigation was going on at the time of the writer's visit, observation of the operation of a pressure breaker in the field was not possible but units in the laboratory appeared to function well.

On one project it was reported that, except for the opening and closing of the control gate at the farm takeout, the ditch riders have no need to regulate the flow anywhere in the system. A farm takeout consists of a gate valve with lock which controls the flow from the pipe lateral, and is either full-open or closed. This valve is operated by the ditch rider. It is followed by another gate valve by means of which the farmer regulates his stream. This in turn is followed by an integrating meter, generally if not always accompanied by a recording device which shows the rate of flow at all times. This last is required for determination of the maximum demand, which is used in fixing charges. Because the water on this project is always clean, no trouble is experienced with the meters.

Complete automatic control in open-channel systems by the use of gates which will keep constant the depth of water downstream is theoretically possible, but so far no practical systems have been worked out. A number of automatic devices for maintaining constant flow in open channels are in use. A long V-shaped weir, shown in a photograph, serves as an upstream constant-level device. The upstream constant-level gate, set below the point where water is diverted from a canal, is the type most commonly used to maintain a uniform diversion. A somewhat similar gate is used to control the level downstream and is often used on small takeouts.

Another very useful device is the set of distributors or constant-flow orifices used to control and measure the flow to a lateral or farm heading (Fig. 3). These act both as supplemental controls and as measuring instruments. They consist of specially shaped orifices or series of orifices each of which can be closed independently by a sliding gate. Orifices of different widths are arranged in groups in such fashion that, by opening different combinations, a wide variety of streams can be measured. For instance, one set includes orifices which pass 5, 10, 15 or 30 liters per sec individually (0.18, 0.35, 0.53, and 1.06 cfs). By using one or more of these, any flow from 5 to 60 liters per sec in 5 liter-per-sec steps can be delivered. The depth of water over the sill for accurate measurement with this unit is 17 cm ($6^3/_4$ in.). This may be decreased to 13.5 cm ($5^3/_8$ in.) or increased to 18.5 cm ($7^1/_4$ in.) without causing an error of more than 5 percent in the flow.

Irrigation systems in Algeria are constructed and operated by the Service of Colonization and Hydraulics of the Algerian Government. The mechanical devices here described were designed and built by the Neyrpic Establishment with headquarters at Grenoble, France. The Thompson Pipe and Steel Co., of Denver, Colo., represents Neyrpic in the United States.

The writer examined irrigation works in Algeria during an assignment from the Bureau of Reclamation, U.S. Department of the Interior, with the Foreign Operations Agency (Point IV) in the Middle East. He wishes to acknowledge the assistance of the engineers of the Service of Colonization and of Hydraulics and the representatives of Neyrpic, which made it possible for him to see and learn a great deal in a very short time.

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International Bridge over Rio Grande at Laredo, Tex., seen above, was covered by previously unrecorded flood height of 62 ft on June 29, 1954. At flood crest, shown in center view, bridge floor was about 22 ft below water surface. Lowered flood waters revealed damage—collapse of three of five arches (far right).

PRESTRESSED-CONCRETE

At the end of June 1954, hurricane Alice wended her unladylike way north and west up the Rio Grande Valley. Starting in the lower Gulf of Mexico, she carried with her huge quantities of moisture for parched southwest Texas. Upstream from Laredo, torrential rains on the watersheds of the Pecos and Devil's Rivers carried flood crests from both streams into the Rio Grande at the same time.

Engineers of the International Boundary and Water Commission estimated, on the basis of measurements upstream from Laredo, that a maximum flood was coming down the valley. On the evening of June 28, 1954, the usually staid Rio Grande started rising rapidly at Laredo, and after 36 hours the water level crested at the previously unrecorded height of 62 ft.

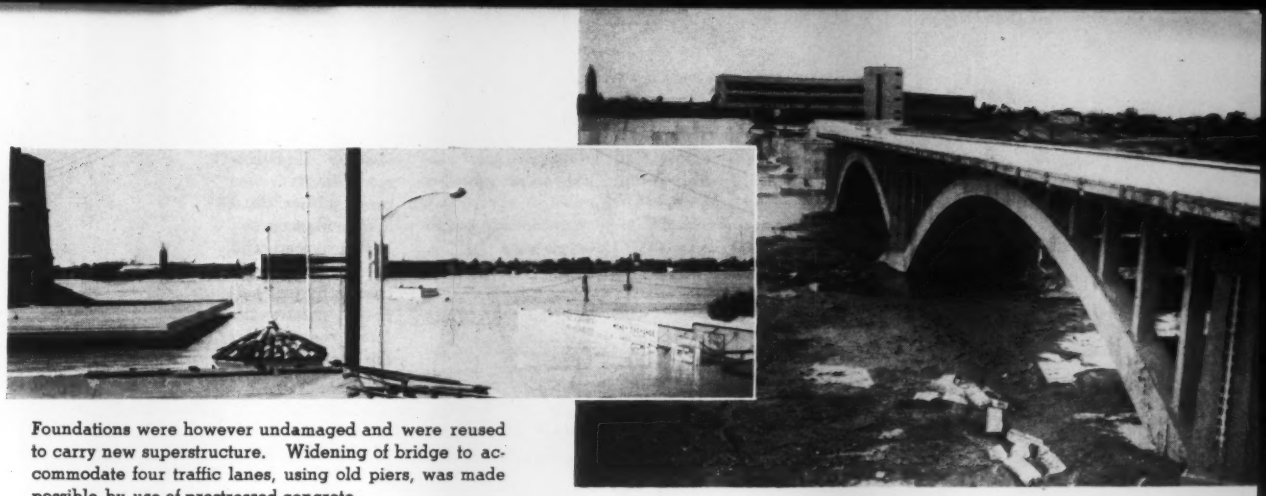
Old bridge collapses under flood

While the flood waters were rising, a "log jam" of debris was being built up against the upstream side of the International Bridge at Laredo. This bridge, consisting of two approach spans and five 150-ft three-hinged arch spans, with the two-lane roadway supported on columns from the arches, acted as a skimmer wall to retain the debris. Also, just before failure occurred, a raft of bridge ties and rails from a railroad bridge which had washed out at Eagle Pass struck an arch span head on. The forward end of the raft rose high on the driftwood and the rear end folded under and around the center of one arch just as three of the five spans failed.

Failure occurred at the springing line due to overturning about the downstream side. Since at this time the bridge was completely under water, the failure could not be seen from the shoreline, but it was felt that the bridge had been badly damaged. At the instant of failure a sudden drop in water level was noticed on measuring gages upstream from the bridge, due to the sudden release of the partially dammed water.

When the flood receded, the owners of the bridge were faced with the problem of getting traffic across the river. The demolished bridge had been a main artery connecting the United States and Mexico, and the resumption of traffic was of paramount importance. The first link was a rubber-pontoon bridge supplied by the U.S. Army, which was used for three weeks while a temporary pontoon bridge for prolonged use was being built. This bridge consists of 43 wooden pontoons carrying a roadway for two lanes of car traffic and two sidewalks. It was designed for rises in water level up to 17 ft, and in August 1955 rode out a flood rise of $14^1/_2$ ft. This bridge is still in use and, with minor maintenance, is standing up well. A low-water bridge was later built upstream from the demolished bridge to accommodate heavy truck traffic.

When the immediate problem of reestablishing traffic had been solved, the problem of reconstructing the permanent bridge remained to be worked out. For this purpose representatives of the Government of Mexico and the City of Laredo, joint owners of the bridge, met in Laredo. They decided that the bridge superstructure should be entirely reconstructed so that the width could be increased to accommodate four lanes of traffic and two 8-ft sidewalks. This involved demolition of the remaining arches of the old bridge and of its approaches. As for materials of construction, it was agreed that concrete manufactured from local materials would be more economical than heavy steel plate girders fabricated and supplied by steel mills in the United States. Once this decision was made, the use of a relatively lightweight prestressed-concrete superstructure became a logical solution, since it was desirable to retain the existing foundations. In spite of the widened roadway, the total dead weight on the pier foundation would remain approximately the same as that of the old two-lane arch superstructure. To minimize the danger from a flood during construction, the bridge was designed to use precast members cast on the high river bank and erected with a minimum of falsework.



Foundations were however undamaged and were reused to carry new superstructure. Widening of bridge to accommodate four traffic lanes, using old piers, was made possible by use of prestressed concrete.

SUPERSTRUCTURE

for flood-wrecked International Bridge at Laredo, Tex.

Various designs studied

Various layouts were studied (Fig. 1), all based on a bridge cross-section consisting of nine girders with a cast-in-place deck between them. Diaphragms for lateral stability were introduced approximately 30 ft on centers but were not taken into account for load distribution between girders.

The first scheme was a simple-girder solution spanning 150 ft from pier to pier. This arrangement was expanded in Scheme 2 so that the girders would act as a continuous system for superimposed loads. This was done by introducing cap prestessing cables over the piers to resist the negative moment due to superimposed loading, with single bearing at each pier instead of the double bearing required for the simply supported girders. The third and fourth schemes also utilized 150-ft girders, but of a double cantilever type. For Scheme 3 the girders were fixed to the piers after erection and joined in the center of the 150-ft span by hinges which remain hinges throughout the life of the structure. In Scheme 4 the same type of girder was supported on the piers by roller bearings and made continuous by prestressing cables through the joint after erection. In Scheme 5 the well-known Gerber beam theory was employed. In this solution, girders approximately 190 ft in length

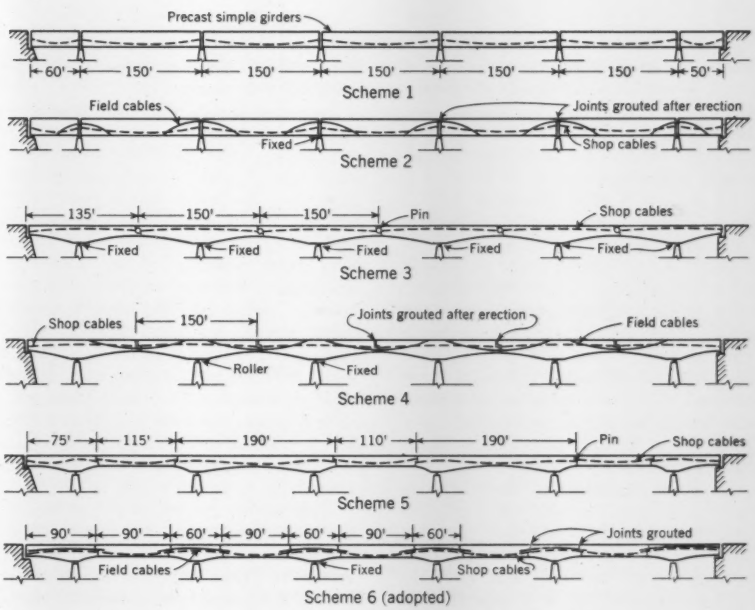


Fig. 1. Before choice of final design, six schemes were studied, all based on a bridge cross-section consisting of nine girders with cast-in-place deck between. Scheme 1 is for simple girders. Scheme 2 utilizes cap prestressing cables over piers. Scheme 3 consists of double cantilever girders fixed to piers after erection and joined in center of spans by permanent hinges. In Scheme 4, similar cantilever girders are supported on piers by roller bearings and made continuous by prestressing cables. Scheme 5 employs Gerber beam theory, with 190-ft girders over every second span and short cantilevers. Scheme 6, that adopted, incorporates short, double cantilevers on each pier, with drop-in members between, the whole made fully continuous by prestressing cables.

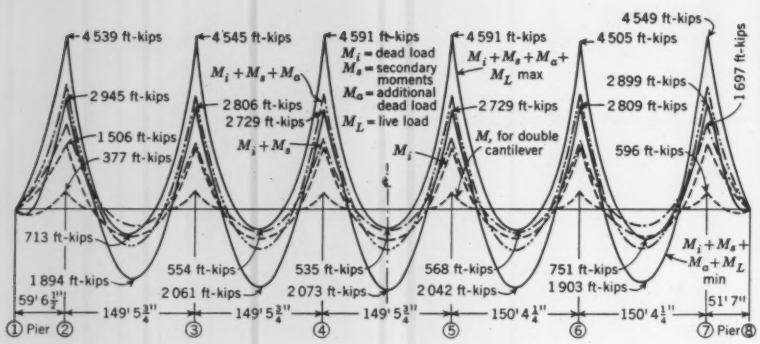


FIG. 2. Final moment diagram was prepared for dead load, superimposed load, live load, and secondary moments caused by that part of prestressing force required for the superimposed load.

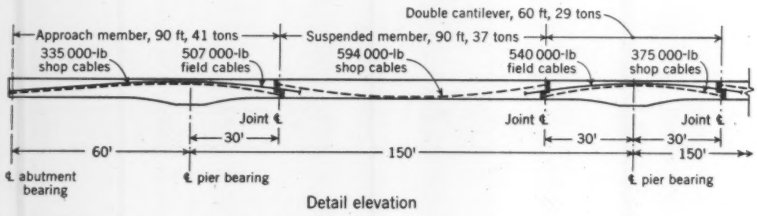


FIG. 3. Detail elevation shows three types of members—approach, suspended, and double cantilever. Center of gravity of prestressing forces is also indicated, by dashed lines for shop prestressing cables and by solid lines for field continuity prestressing cables. Forces are for roadway girders.

would be erected over every second span, with short cantilevers extending out from the piers on each side. Between these cantilever ends, drop-in members would be placed and permanently pin connected.

In Scheme 6 (also shown in Fig. 1) short, double cantilever members would be erected on each pier and temporarily supported at their ends. Drop-in members would be placed between the ends of these double cantilevers. The entire structure would then be made fully continuous for superimposed load by prestressing cables extending from the end of one suspended beam through the double cantilever over the pier, and anchored at the near end of the adjacent suspended beam.

After careful study of these layouts, it was decided that Scheme 6 afforded the best all-round solution for the problem at hand. This solution required precast members that would be considerably lighter and shorter than any of the others. From the point of view of final stability, it was equaled only by Schemes 2 and 4. Scheme 6 utilized less material than the other schemes with the exception of Scheme 4. However Scheme 4 had two obvious disadvantages that caused it to be eliminated—unfavorable deflection characteristics and the necessity for full fixity at the piers. Such fixity was questionable and undesirable when using the old foundations.

The final design was then prepared based on Scheme 6. The live loading utilized was AASHO H2O-S16 on four lanes with impact. The superimposed dead load included cast-in-place diaphragms, floor slab, and 2 inches of asphalt. Approximate shapes of members were assumed, from which a preliminary moment diagram was obtained. From this diagram, approximate points of contraflexure were obtained, and chosen as the location of joints between precast elements. From this preliminary moment diagram, section properties were also determined and a final moment diagram for dead load, superimposed load, and live load calculated, as shown in Fig. 2.

Next the magnitude of the prestressing force required to resist these moments was calculated. A portion of this force—that required for the dead load of the precast elements only—is to be introduced into the members before erection. After erection, the remainder of the prestressing force—that required for the superimposed load—will be introduced to make the structure function as a continuous girder system. The latter part of the prestressing force causes secondary moments in the structure, also shown in Fig. 2. While not of appreciable magnitude in this case, these secondary moments should always be determined when designing statically indeterminate prestressed concrete structures. When all moments and prestressing forces had been ascertained, all the stresses were calculated to make sure that they would fall within allowable values.

The allowable stresses follow in general the values outlined in the *Criteria for Prestressed Concrete Bridges* published by the U.S. Department of Commerce, Bureau of Public Roads. The specifications called for a 28-day cylinder strength of concrete in the precast members of 5,500 psi. Allowable stresses were based on this strength. The concrete in the cast-in-place sections was specified to develop a 28-day strength of 3,000 psi. Because of the relatively thin sections, the maximum size of aggregate in the precast members was held to $^3/_4$ in.

Prestressing tendons were specified to be composed of parallel-lay wires of an ultimate strength of between 200,000 and 240,000 psi. The wire was to be hard drawn, stress relieved, with a diameter of at least 0.196 in. and not exceeding 0.276 in. It was also specified that all tendons be pressure grouted after prestressing, for protection of wires and to provide bond between the wires and the concrete girder. The initial allowable stress in the wire was

FIG. 5. Precast girders were transported from casting yard by means of railroad track running over temporary Bailey-type bridge erected along center line of structure. They will then be moved sidewise to final position by overhead crane, seen in cross section. Crane is supported by falsework towers shown in small sketch.

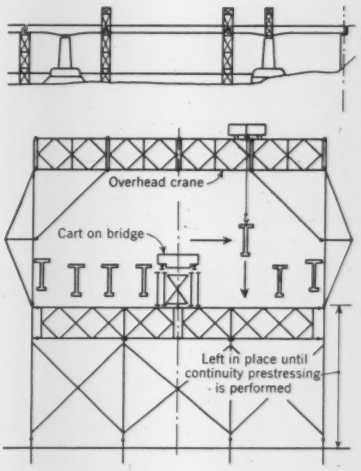
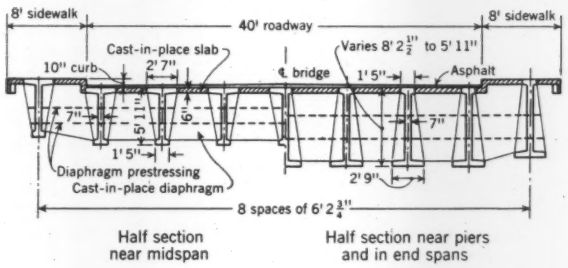


FIG. 4. Cross section of bridge shows nine girders spaced 6 ft 2 in. on centers. Each girder is made up of 11 precast elements as indicated in Fig. 1, Scheme 6.



to be 0.7 of the ultimate strength, or 0.85 of the yield strength as determined by 0.2 percent offset, whichever value was the lower. The final required prestressing force after all losses was shown on the plans, as well as the calculation of losses that were to be expected due to shrinkage and plastic flow in the concrete and relaxation in the wire. The prestressing was shown in this manner so that any recognized system of wire prestressing could be used.

As shown in Fig. 3, the bridge is composed of three distinct types of member—an approach member, a suspended member, and a double cantilever member. Over each pier there is a double cantilever member of 60-ft length, its depth varying parabolically from 8 ft 2 in. over the pier to 5 ft 11 in. at the ends. This member, an inverted T-section, has a weight of about 29 tons. Between two double cantilever members is placed a suspended member about 90 ft in length. It has a normal T-section of a uniform depth of 5 ft 11 in. and weighs about 37 tons. At each end of the bridge there is an approach member about 90 ft long, with the same parabolic haunches over the pier as in the double cantilever. This approach girder, weighing 41 tons, is also an inverted T-section.

The cross section of the bridge is composed of nine girders spaced 6 ft 2 in. on centers (Fig. 4). Each of these girders is composed of eleven of the above mentioned precast elements, which are joined together by prestressing cables after erection to form a continuous girder 860 ft in length. Diaphragms are then cast between the girders and prestressed to tie the girders together. The next step is to cast a 6-in. slab of reinforced concrete between the top flanges of the girders.

The center of gravity of the prestressing forces is shown in Fig. 3, the dashed lines indicating the shop prestressing, and the solid lines the continuity field prestressing.

The old bridge piers were used with modifications, and the foundations were not altered. The piers were increased in width at the top to accommodate the greater width of the superstructure. They are tapered smoothly from the new width at the top to the original dimension at the base. This gives a pleasing architectural effect.

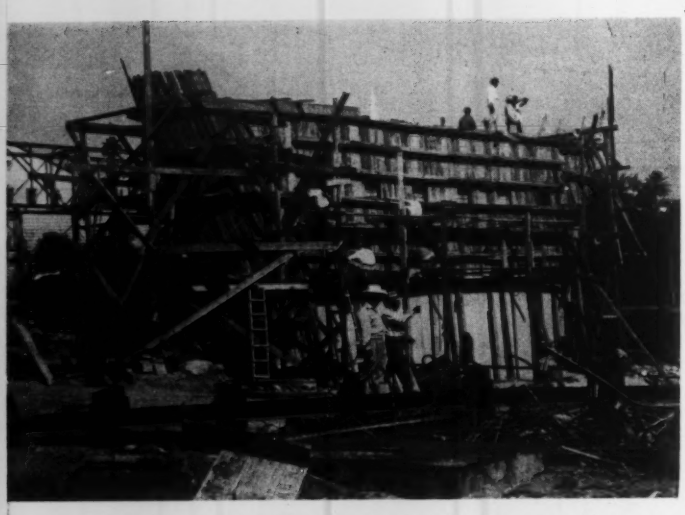
Because of the international character of the bridge, the plans and specifications were prepared in both Spanish and English, and all dimensions and quantities were shown in both metric and English units. This was done to facilitate bidding, as both Mexican and United States contractors were expected to submit bids.

Through an agreement between the governments of the United States and Mexico, an area close to the bridge was designated an international zone, into which materials to be incorporated in the structure could be brought from either country without duty.

In the early summer of 1955, bids were received from both Mexican and United States contractors. When the bids were opened, it became evident that the low cost of Mexican labor and materials gave the Mexican contractors an advantage which more than offset the bonus the owners were prepared to pay for an early completion date. The highest bid of a Mexican contractor was approximately 60 percent of the low United States contractor's bid. The contract was awarded to Concretos, S.A., of Monterrey, Mexico, in August 1955. The total contract is for a little over 5,000,000 pesos, of which about 80 percent is for the superstructure. Converted to U.S. currency, the cost of the superstructure is about $335,000, or about $7 per sq ft on 48,200 sq ft of bridge deck. The low United States contractor's bid, when broken down, showed a unit cost of $12.50 per sq ft of bridge deck.

The contractor elected to use two well-recognized prestressing systems in the construction. Ordinarily more than one such system is not used in the same

Floating bridge supported by 43 wooden pontoons replaced emergency rubber pontoon bridge erected by U.S. Army. Wooden-pontoon bridge is here seen carrying traffic at a river stage of 14 ft.



Old piers were reused but sloped outward from base to top to accommodate wider superstructure, which provides four-lane roadway instead of two lanes on former structure.

Nine girders in approach span on United States side are being cast in place because of their weight. Note tapered pier in center foreground.

structure. However, in this bridge each system is used to its best advantage. The BBRV system, the Swiss single-headed wire system, is used for the shop prestressing tendons in the precast elements, where it is desirable to introduce a large force per tendon and where the tendons are placed in the forms before casting. The maximum unit of this type consists of 25 wires of 0.250-in. diameter, with an initial force of 100 tons. The PI system, an American method utilizing duplex-headed wire, is used for the continuity field cables because these tendons can be introduced with ease after precasting and erection. The maximum unit of this type consists of 12 wires of 0.250-in. diameter, with an initial force of 50 tons.

The wire used is manufactured by the Union Wire Rope Corporation and has an ultimate strength of 240,000 psi. By combining the two systems, the contractor was able to obtain a straightforward solution for the prestressing phase of this construction. All prestressing tendons are placed in flexible metal tubing, which forms ducts through the members. After the tendons are stressed, these ducts will be pressure grouted.

Concrete of sufficient strength to meet the specifications could be made from local aggregates and cement manufactured in the immediate vicinity. Mexican cement was found to produce concrete that was slightly darker than that produced with cement from the United States. Hence it was decided to use United States cement for the facia girders and in piers and abutments. Mexican cement will be used for interior girders and slabs, thus making the construction truly international. The specified concrete strength is secured with about 9 sacks of cement per cubic yard of concrete with a 4-in. slump. The precast members are cured following AASHO water-curing standards.

Forms for the girders are made of 18-gage sheet steel, bent to the required shape and stiffened with box-shaped elements of the same material. The forms are built in sections small enough to be handled by one man. Removable window panels are built into the web sections to facilitate placing and vibration of the concrete in the bottom flanges of the girders. Forms are braced against a steel scaffolding extending the length of the girder. This scaffolding also supports runways for concrete buggies.

Most of the precast members are cast in a yard on the Mexican side of the river. In order not to overload the capacity of the erection equipment, the heavier girders for the United States approach are cast in place. As shown

in a photograph, these girders are cast on a wooden platform extending across the entire width of the bridge. The double cantilevers and suspended members are being cast in the yard.

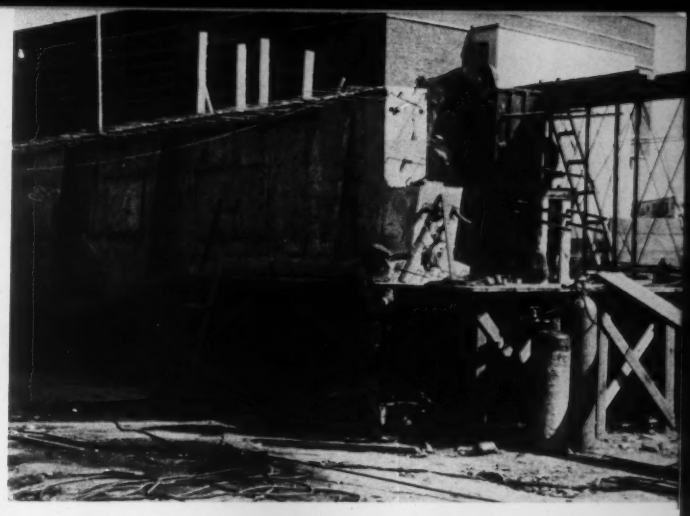
For the transportation and erection of the precast members, a railroad track will be run from the casting yard over a temporary Bailey-type bridge, which is being erected along the center line of the structure. The girders will be rolled out on railway trucks to their approximate position and then will be moved sidewise to final position by an overhead crane, as shown in Fig. 5.

The sequence of construction will be as follows. The double cantilevers will be placed first and temporarily supported on falsework, as shown in Fig. 5. The dropped-in members will then be placed in position on temporary seats on the ends of the double cantilevers. Joints will be poured, and when they have set to the specified strength, the field prestressing units will be stressed across the joints. At that time the temporary supports will be removed, the diaphragms poured and stressed, and the roadway slab cast.

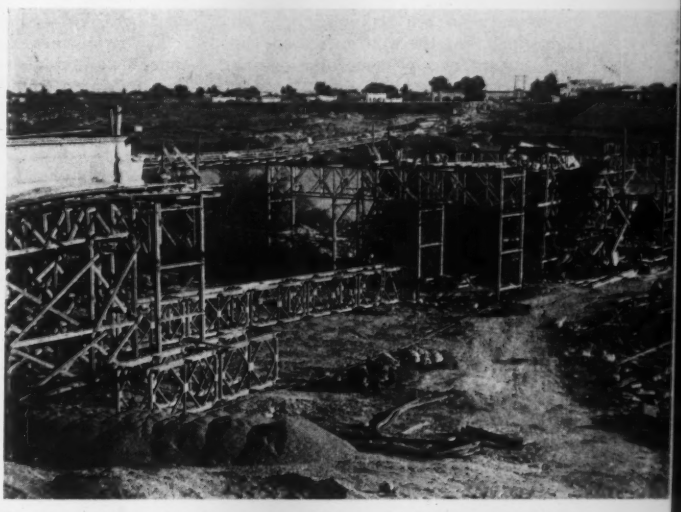
When the structure is completed, the removable aluminum hand railing, which had been taken off of the old structure when the flood was imminent, will be reinstalled. The bridge will then appear as shown in the accompanying architectural rendering.

The new bridge was designed in the offices of the Secretaria de Communicaciones y Obras Publicas in Mexico City, which furnished most of the design personnel. Cooperating in the design and in the checking and coordination were personnel from the offices of Beretta, Greenslade, Clark & Collins, Inc., of San Antonio, Tex., who were consultants and engineering advisers to the City of Laredo from the time of the disaster to the construction stage. They in turn retained the services of Prestressing Research & Development, Inc., of San Antonio, for consultation on the prestressed concrete superstructure design. F. E. Koebel, co-author of this article, represented Prestressing Research & Development. General Work Director for the construction is Ing. Jorge Garcia Obregon, and Resident Engineer for the City of Laredo is Bengt Sonesson, co-author of this article.

(This article was originally presented by the writers as a paper at the ASCE Dallas Convention, before the joint session of the Highway and Structural Divisions, presided over by Randle B. Alexander, and Phil M. Ferguson, members, respectively, of the Highway and Structural Divisions' committees on session programs.)



Precasting yard for girders is on Mexican side of Rio Grande. Here double-cantilever members, each 60 ft long and weighing 29 tons, are being cast by contractor, Concretos, S.A. These elements rest on piers and support suspended members, each 90 ft long and weighing 37 tons.



Temporary falsework is being erected to support Bailey-type bridge on center line of structure. This bridge will carry railroad tracks for use in moving precast members to their approximate position. An overhead crane, shown in Fig. 5, will move them transversely into exact position. Note temporary pontoon bridge in background.

New bridge, seen in artist's sketch, carries four-lane roadway and two sidewalks. Aluminum railings, of removable type, were salvaged from old bridge when flood threatened.

Wind forces on free-swinging signs

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S. J. WILLIS
Research and Development Engineer

The Union Metal Manufacturing Company, Canton, Ohio

So far as the writers can determine, there has been no adequate study of wind pressures on free swinging signs. It has been generally recognized that a swinging sign has less resistance to the wind than one held at right angles to the wind. During the wind storms of 1954 and 1955, one of the writers had the opportunity to see swinging signs in high winds. As the wind increased, the signs swung nearly horizontal, giving rise to the question as to what the drag on the sign should be at maximum wind.

A study of the available data revealed curves of wind drag and lift in the general sizes and shapes in question. The most reliable data seemed to be in "Aerodynamics," by L. J. Briggs and H. L. Dryden, in the *International Critical Tables*, Vol. I, 1926, pages 402–411.

The problem seems straightforward enough at first glance. It is assumed that a hinged flat plate will take an angle with the horizon depending on three forces: gravity, drag D, and lift L. See Fig. 1.

This is complicated somewhat by the fact that the center of pressure of the wind force varies from the mid-point at $\alpha = 90$ deg to a point near the leading edge as the angle α decreases.

Assuming steady forces on a sign of unit depth and unit length, the sign will come to rest when the sum of the moments around the hinge from the forces of the wind and gravity are equal to zero, that is when $\Sigma M = 0$; and when $M + W = 0$. Now from Fig. 1 we see that,

$$M_W = D \times \sin \alpha \times C_2 + L \times \cos \alpha \times C_2$$

$$M_B = -W \times C_1 \cos \alpha$$

$$\text{or, } 0 = D \times \sin \alpha \times C_2 + L \times \cos \alpha \times C_2 - W \times C_1 \cos \alpha$$

Now glance at the curves of Fig. 2, for three aspect ratios, which are copied from Tables 6, 7, and 8 of the *International Critical Tables* (by permission of National Research Council). You will note that the coefficients of drag and lift (C_D and C_L) are irregular curves; that they vary somewhat with the aspect ratio, A_r (length of sign along hinge

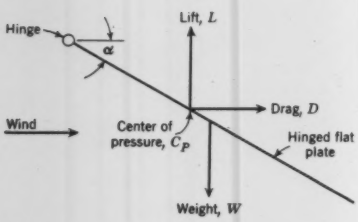
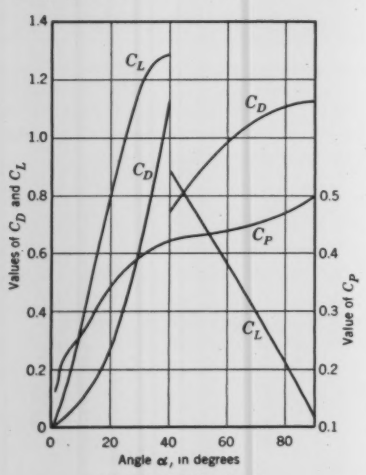
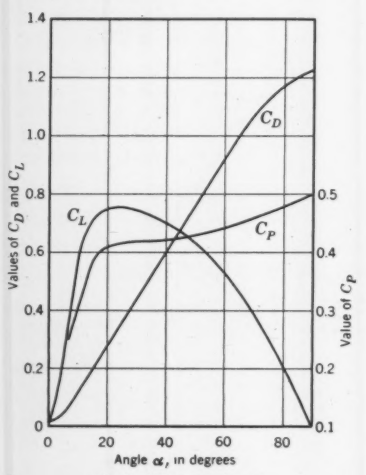


FIG. 1 (Above). Hinged flat plate represents sign acted on by forces of gravity, drag, and lift.

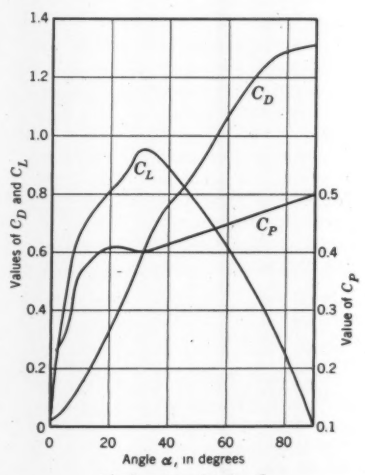
FIG. 2. Coefficients of drag and lift (C_D, C_L) are irregular curves which vary somewhat with aspect ratio A_r (length of sign along hinge divided by depth). In certain cases there are two values for each curve. Three cases are given—for three values of aspect ratio, 1, 3, and 6.



(a) Aspect ratio, $A_r = 1$

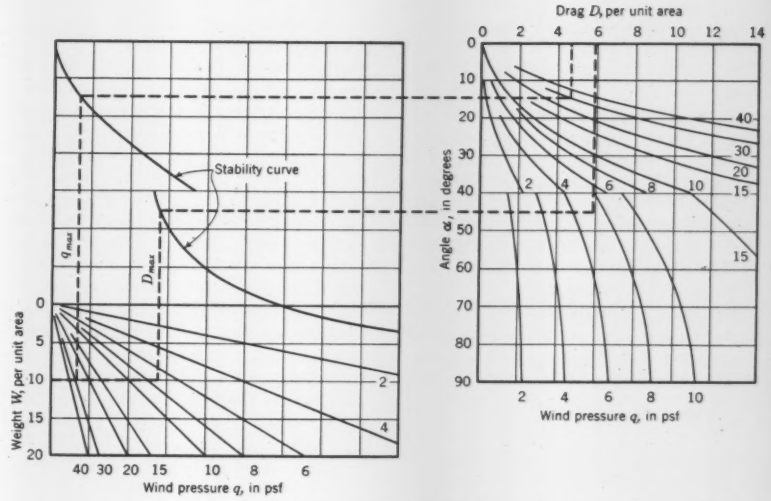


(b) Aspect ratio, $A_r = 3$

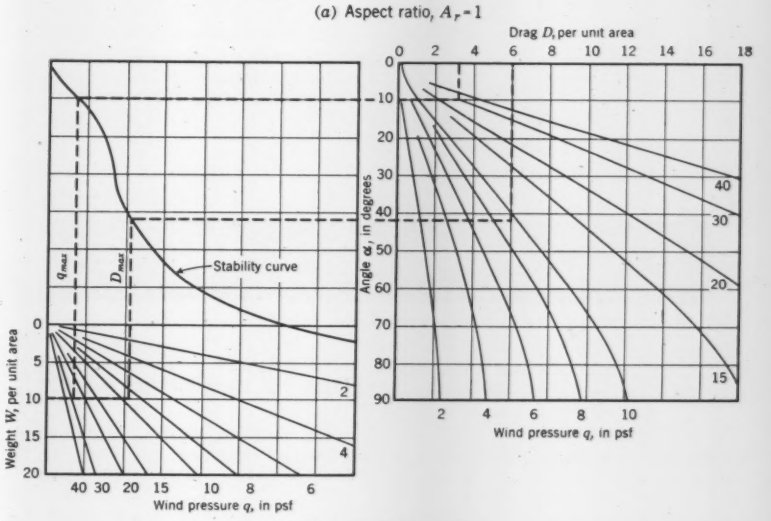


(c) Aspect ratio, $A_r = 6$

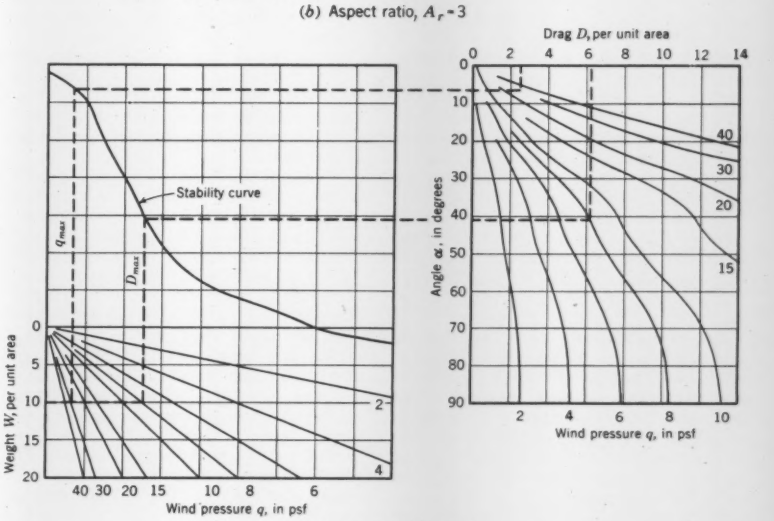
Fig. 3. By assuming a fixed angle and wind pressure, weight of sign can be found directly, and curves used to obtain drag, D, per unit area of sign. Curves are here plotted for ratios, A_r, of 1, 3, and 6. Dashed lines show solutions for maximum q and maximum D in Example 1.



(a) Aspect ratio, $A_r = 1$



(b) Aspect ratio, $A_r = 3$



(c) Aspect ratio, $A_r = 6$

divided by depth); and that there are two values in certain cases for each curve. Since we are interested in the maximum drag on the sign, we will use the values giving the maximum drag, where there is more than one value.

In solving the problem, if we attempt to assume a given weight of sign and a given wind pressure, and then find the angle, we are faced with an almost impossible problem of cut and try. If, however, we assume a fixed angle and wind pressure, we can solve for the weight of the sign directly. By choosing various angles and wind pressures, we can plot curves showing these relationships and from these curves can also obtain the drag per unit area of sign. These curves have been plotted in Fig. 3 for aspect ratios, A_r, of 1, 3, and 6.

It should be noted that the maximum value of drag might not occur at the maximum value of q, or wind pressure, since the sign may be blown up to an angle where the resistance is less, despite increased pressure of the wind. In this case, all values of q below the maximum wind pressure must be investigated to be sure of getting the maximum value of drag. If the problem is to support both a fixed sign and a swinging sign, the sum of the drags needs to be studied at all wind pressures to determine the maximum total drag.

From the examination of the values of flat plates given in the *International Critical Tables* for friction, the friction values are about 1 percent of the drag values and have been included in the drag curves.

The leading and trailing edges should be taken as fully resistant to the specified wind, since they are generally not important, and thus any error will be on the safe side.

There is a small inertia effect of the reaction to the sign swinging away from the wind. This reaction is wholly due to the polar moment of inertia of the sign. Taking an extreme case of a sign 10 ft high, made of 2-in. oak, the inertia force imposed on the hinge from a wind velocity change of 20 miles per hour per second (mph per sec) is only about 1 percent of the drag force, and this inertia is at right angles to the sign. The centrifugal force of the sign is also a factor. For this same sign, considering it to be at an angle of 45 deg or the angle of maximum drag, the centrifugal force

developed will be about $4^1/_2$ percent and will be in the direction of the sign, or about 3 percent in the direction of the drag.

To provide an adequate factor of safety, the writers suggest that 10 percent be added arbitrarily to allow for edges, fraction, inertia, and centrifugal force. Where the obstructions are greater than 5 percent of the sign face, it is suggested that these drag surfaces be figured separately and added to the 10 percent above mentioned.

Example: What is the wind force on a hinged sign 7.5 ft long, 2.4 ft deep, of 1-in. plywood and steel, with a maximum wind pressure of $q = 30$ psf. The sign weighs 180 lb and is hinged at its upper edge.

$$\frac{W}{A} = \frac{180}{7.5 \times 2.4} = 10 \text{ psf};$$

$$A_r = \frac{7.5}{2.4} = 3.12$$

We choose the curves in Fig. 3(*b*), which has the closest aspect ratio, and get the intersection of 10 psf and 30 lb of wind pressure. As shown by the dashed line marked q_{max}, we then project vertically to intersect the stability curve and find that the angle is about 10 deg. We next project horizontally to intersect the curve of 30 psf. From this curve we project upward to read the drag of 3.2 lb per sq ft. The drag on the sign at this wind pressure is thus $3.2 \times 18 = 57.6$ lb.

However, the sign support must also withstand lower wind pressures, which may produce a greater drag force. Examining successive values of wind pressure, we find that at about $q = 9.5$ we have a drag of 6.0 psf, as shown by the dashed line marked D_{max} in Fig. 3(*b*). Then, $6.0 \times 18 = 108$ lb of total drag. Multiplying by a factor of 1.10, we get a maximum load of 119 lb of drag. Similar solutions are indicated on Fig. 3(*a*) and (*c*) for aspect ratios of 1 and 6.

This study and example are for rectangular signs, but the figures are applicable to circular signs when the necessary correction is made for area. This is according to Hoerner (Fig. 3.9, taken from *Ergebnisse A VA*, Göttingen, Vol. 4, München 1932).

Notation

- A = Area of sign in sq ft
- A_r = Aspect ratio, total length of sign along hinge, divided by total depth
- C_1 = Distance from hinge to center of gravity of sign
- C_2 = Distance from hinge to center of pressure of sign
- C_D = Coefficient of drag
- C_L = Coefficient of lift
- C_P = Center of pressure as a ratio of depth of sign
- D = Drag = $C_D q$, in psf
- L = Lift, in psf
- q = Wind pressure, in psf
- W = Weight per sq ft of sign
- M_q = Moment due to wind
- M_w = Moment due to weight
- α = Angle of sign with horizontal

THE READERS WRITE

Bidding for engineering services—a neglected aspect

TO THE EDITOR: During the past few months, civil engineering periodicals have carried numerous articles and letters on bidding for engineering services. The general opinion has been that such bidding is unprofessional and unethical. The favorite example cited is the action of ASCE in depriving several men of their membership for alleged activity in such bidding practice.

In the discussion to date, emphasis has been on bidding by consulting firms, not by individuals. A common procedure that makes bidding for engineering employment necessary has been ignored. Wholesale requests for bids are being invited every day, every week, by employers who advertise for engineers and conclude with the request, "Send full résumé, including *salary desired* to . . . ."

Consulting offices and engineering organizations run by men in the highest offices and councils of NSPE and ASCE are indulging in this practice. The *American Engineer*, CIVIL ENGINEERING, and *Engineering News-Record* are a few of the technical publications which accept such advertisements for their "positions available" columns.

Obviously the employers are not bidding for engineering services. They are merely requiring the applicant to do so. Employers need not hire solely on the basis of salary—other qualifications of the applicant can be examined also. This is likewise true for a highway bridge department which can consider the strong points (besides the low fee) of firms which submit bids for services. If an employer asks for salary requirements, or a state highway department asks for a bid on engineering fees, the intent is to use the information obtained in selecting the winner.

Personnel relations are not improved by employers who ask for salary bids. Examples could be given of engineers who quoted too low a salary and later found that other men, no better qualified, asked for and got higher starting salaries. Conversely, good men who put an "ignorance-of-conditions" factor in their salary bid, and know their own worth, may be ruled out. If the demand for engineers drops, bidding for a job on the basis of stipend will be a more serious matter. Generally, only government positions have fixed salary limitations. Stating these limits in the advertisement will save time for both employer and applicant and eliminate the need for the "salary desired" question.

The writer has consistently advised his civil engineering students not to include a salary bid in application letters or forms. If a space for "salary desired" is given on an application form, the words "open" or "dependent upon conditions" are recommended. Incidentally, graduates are also counseled not to accept jobs carrying an hourly wage (instead of a salary), even during the engineer-in-training period.

When a contract for engineering services is to be let, the pertinent conditions and plans are made known to interested parties. A fee is determined by consultation and negotiation. Why not follow the same system in hiring an engineer for a specific job? The following advertisement implies such an arrangement and has a dignity befitting the engineering profession:

"*Highway engineers.* Overseas and domestic. Applications are now being accepted for a limited number of additional openings. . . . Top salaries commensurate with education and experience, plus employees' benefit and retirement plan."

The ethics and professional desirability of bidding for jobs on the basis of salary is an issue that the professional and technical societies must face. The committee studying this matter should consider all variations of the problem, including the aspect here discussed. If it is agreed that the present practice is wrong, engineering periodicals will quickly refuse to accept advertisements with the undesirable "salary expected" clause.

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Virginia Polytechnic Inst.
Blacksburg, Va.

The vertical curve—a baffling problem

TO THE EDITOR: In computing elevations on a vertical curve by addition of increments, in his article in the June 1955 issue (p. 60), Edmund R. Preston, Jr., made one error in arithmetic at Sta. 30 + 50 which makes all elevations beyond this station incorrect.

The vertical curve presents a baffling problem, mostly because of the way it is generally handled. The classic formula for a parabola with the axis vertical is $x^2 = 4fy$, where f = focal length for problems dealing with parallel rays. Since $4f$ is a constant, why not use it? Letting $4f = 1/k$, we can write $y = kx^2$. See Fig. 1. Working from the apex, this equation is simple.

Engineers generally know the simple-beam formula, $m = wL^2/8$. Some know that m at any point x is $\frac{wx}{2}(L - x)$. However, few realize that this is also $\frac{w}{2}x(L - x)$, which is also $kx(L - x)$. This last form also applies to ordinates for a vertical curve from a chord, as shown in Fig. 2.

In the example given by Mr. Preston, $a = +2$, $b = -3$, $L = 18$, and the elevation of the P.C. is 136.00 at Sta. 25 + 76. The elevations from this point are $136.00 + ax - kx^2$. From Fig. 1,

$$A = a - b = 2 + 3 = 5$$
$$k = A/2L = 5/36 = 1/7.2$$
$$Y = \frac{a^2 L}{2A} = 7.2 \text{ ft}$$
$$X = aL/A = 2(18)/5 = 7.2 \text{ stations}$$

or $a/2k = 7.2$ stations.

Since elevations are wanted at even stations and half stations, the second difference is found in Table I, letting I = increment = 0.5 stations.

Note that when $x = I$ or zero, kI^2 is half the normal difference.

$$2kI^2 = 1/14.4 = 0.06944$$
$$k(2xI^2 + I^2 - x^2) = 0.0692$$

and $kx^2 = 0.0294$

STATIONS	dy	Σdy	ELEVATIONS
32 + 96 (apex)			143.2000
32 + 50	0.0294		143.1706
32 + 00	0.0692	0.0986	143.072
31 + 50	0.06944	0.16804	142.904
31 + 00	0.06944	0.23748	142.6665
30 + 50	0.06944	0.30692	142.3596
30 + 00	0.06944	0.37636	141.9832
29 + 50	0.06944	0.44580	141.5374
29 + 00	0.06944	0.51524	141.0222

Checking from the apex,

$$y = (3.96)^2/(7.2) = 2.178.$$

Therefore the elevation at Sta. 29 + 00 is (143.2000 − 2.178), or 141.022 exactly.

The equation for direct computations from the horizontal chord through the P.C. is shown in Fig. 2. The equation becomes $z = kx(C - x) + 136.00$. See Table II for computations.

From these computations it is easy to see that if differences are used they should be started at the apex. Direct computations from the horizontal tangent at the apex or from a horizontal chord through either the P.C. or P.T. will reduce the amount of work as well as the likelihood of errors.

The value of the constant k is a key to the sight distance, and when k = zero, the parabola is a straight line. As k increases or decreases the sight distance decreases. If the assumed eye height and object height are chosen, then the k value can be determined.

It seems to me that kx^2 or $kx(C - x)$ are so simple to use that trying to compute elevations by the summation of differences is a waste of time. Any error in the summation of differences carries over, as shown in Mr. Preston's example.

CHARLES MACKLIN, M.ASCE
Architect and Structural Engineer
Springfield, Ill.

FIG. 1

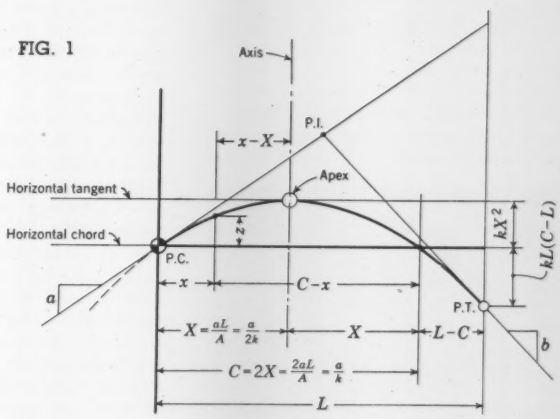


TABLE I. Computation of second difference

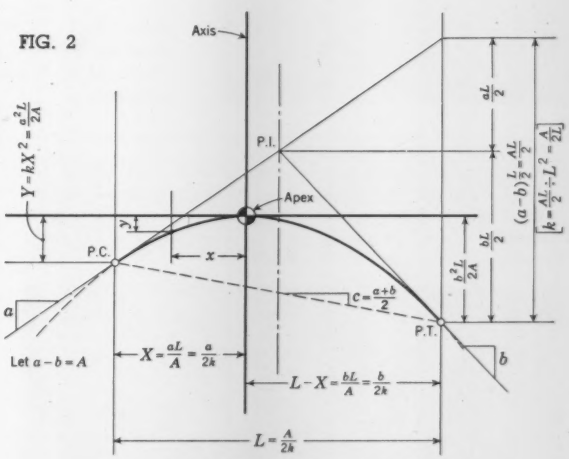
	FIRST DIFFERENCE	SECOND DIFFERENCE
$y_4 = k(x + 3I)^2 = k(x^2 + 6xI + 9I^2)$		
$y_3 = k(x + 2I)^2 = k(x^2 + 4xI + 4I^2)$	$k(2xI + 5I^2)$	
$y_2 = k(x + I)^2 = k(x^2 + 2xI + I^2)$	$k(2xI + 3I^2)$	$2kI^2$
$y_1 = k(x + 0)^2 = kx^2$	$k(2xI + I^2)$	$k(2xI + I^2 - x^2)$
	kx^2	

TABLE II. Solutions for equation of Fig. 2

STATION	x	$C - x$	$x(C - x)$	$1/7.2\,z$	ELEVATIONS
25 + 76	0	14.4	0	0	136.000
27	1.24	13.16	16.3184	2.266	138.266
29	3.24	11.16	36.1584	5.022	141.022*
31	5.24	9.16	47.9984	6.666	142.666
33	7.24	7.16	51.8384	7.1998	143.1998
35	9.24	5.16	47.6784	6.622	142.622
37	11.24	3.16	35.5184	4.933	140.933
39	13.24	1.16	15.3584	2.133	138.133
41	15.24	− 0.84	−12.8016	− 1.778	134.222
43	17.24	− 2.84	−48.9616	− 6.801	129.199
43 + 76	18.00	− 3.60	−64.8000	− 9.000	127.000

* The starred elevation checks with the above computations.

FIG. 2



(The Readers Write is continued on page 102.)

SOCIETY NEWS

DALLAS CONVENTION FEATURES

Transportation by Highway, Airplane, Waterway and Pipeline

Members stand in line to buy tickets as registration begins at Dallas Convention. J. R. Padgitt, registration chairman, stands in front of the banner. Total registration was 1,600.

Mayor R. J. Thornton of Dallas (left), President Needles, and Governor Allan Shivers of Texas confer at the Governor's Luncheon.

Texas' outspoken governor, the Hon. Allan Shivers, took time in his welcoming address to tell the Convention of the Society in Dallas, "We have to match, in the field of economics and government, the imagination and initiative shown in the fields of science and engineering. I simply do not believe that the highway problem can be solved simply by turning it over, lock-stock-and-barrel, to the Federal Government." He sees no difference between federal aid for highways and federal aid for schools. Pointing out that water in Texas is more valuable to growth than the state's great resources of oil and gas, the Governor lauded the widespread group interests in Texas that, over the past five years, have successfully financed needed water projects by the cooperative efforts of municipalities alone or with the help of industry and agriculture. "Federal aid brings with it controls," he said. Local initiative must not be renounced. He made it clear that Texans do not propose to accept federal control in exchange for federal aid.

The five-day ASCE Convention, carefully arranged and carried out by the big and active Texas Section, attracted 1,400 members, their ladies and guests, plus 200 members of 13 Student Chapters. A diverse technical and professional program included valuable papers contributed by every one of the Society's Technical Divisions, and by the Committee on Conditions of Practice. These papers, 83 in number, covered projects of concern not only to the rapidly growing city of Dallas but also to the whole Southwest. The professional subjects were of universal appeal.

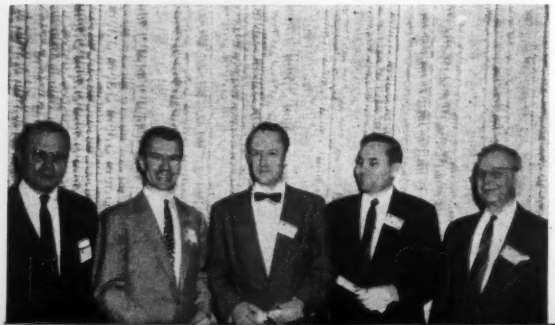
Technical Program Reviewed

A Memorial Auditorium of unique design is under construction in Dallas. A huge spherical concrete dome will rest on the ends of beams, cantilevered inward and horizontally from the tops of a series of heavily reinforced concrete columns located circumferentially around the dome. A paper on design, by Boyd G. Anderson of New York, and another on the construction problems involved by H. P. Farnsworth, Jr., the New Orleans contractor, are scheduled for publication in CIVIL ENGINEERING to coincide with completion of the dome early this summer.

Dallas is also getting an expensive expressway, a toll turnpike connecting with Fort Worth, 30 miles to the west. Work began in September 1955, and it is expected that the divided highway, three lanes in each direction, will be opened to traffic in July 1957. According to J. C. Dingwall, M. ASCE, engineer-manager,

Credit for smoothly run Convention goes to Prof. I. W. Santry, Jr., general chairman, at right in photo; to Texas Section President J. W. Porter, who stands next to him; and to hard-working local members. Here they confer with President Needles, Executive Secretary Wisely, and Prof. Frank Mirgain.

President Needles (left) and Elmer K. Timby (right) flank winners of Society's Research Awards—Dr. Beedle, of Lehigh University; Dr. Hognestad, of Portland Cement Association; and Professor Morgan, University of Iowa.



Four happy Texas members of ASCE get together. They are, left to right, Charles M. Davis, Fort Worth, chairman, Construction Division, and one of organizers of Texas Section in 1913; Carr Forrest, Dallas consultant and past-president, Texas Section; Ross White, Houston contractor and newly elected Life Member; and William M. Golston, Corpus Christi contractor.

Out-of-states visitors at the two-day Local Section Conference are, left to right, Jorge J. Jimenez Lopez, president, Puerto Rico Section; Marcelo Gonzalez, secretary, Venezuelan Section; Miguel Montes de Oca A., secretary-treasurer, Mexico Section; Don Austin, secretary, Hawaii Section; and Julio G. Rolenson, Puerto Rico Section.

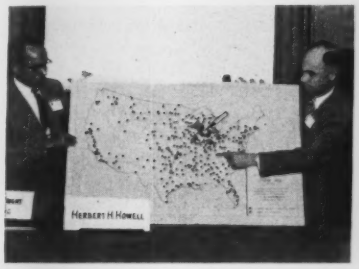
Texas Turnpike Authority, the right-of-way, which will cost close to $10,000,000, has been obtained for a procurement cost of but 5 percent, including court costs, with less than 12 percent of the parcels going to condemnation in which actions the court awards were within 1 percent of the appraisal. A 38-ft-long model of the Dallas-Fort Worth Turnpike, set up in the foyer of the Baker Hotel's ballroom, attracted a lot of attention.

In Dallas, too, a water shortage is impending, according to James A. Cotton, M. ASCE, of Dallas. Present reservoirs on tributaries of the Trinity River can supply 164 mgd. By the year 2000, however, Mr. Cotton predicted that this must be increased to 485 mgd because of two factors: four-fold increase in population, and 45 percent increase in the per capita consumption of water—from 140 to 200 gpd. The voters of Dallas have approved a $20,000,000 dam on the Sabine River to produce the added municipal water needed.

Bordering on the Gulf of Mexico and on the Rio Grande, Texas has water transportation problems. Civil engineers are busy improving inland waterways and harbors along the Gulf, and controlling floods on the river that marks for 1,240 miles the boundary between Mexico and the United States.

At Corpus Christi the nation's youngest harbor, opened to traffic in 1926, has grown to rank ninth among the ports of the United States. Duane Orr, A.M. ASCE, district engineer for the port of Corpus Christi, pointed out that the entrance to the harbor is blocked by a low-level bascule-bridge crossing used by several railroads and a state highway. Even with the bridge open, tankers frequently collide with the bridge in navigating through the narrow skew channel. Large tankers do not try to enter the port. The solution is a six-lane high-level bridge to replace the bottleneck. An article by Mr. Orr dealing with the problem appears in this issue, together with a presentation by Pat W. Clark, bridge engineer of Houston, on design details of the new structure.

On both sides of the Rio Grande for 180 miles upstream from the Gulf nearly one million acres of rich land are under cultivation. So said J. C. Bustamente of Juarez and J. F. Friedkin of El Paso, both members of ASCE and, respectively, principal engineers of the Mexican and the United States sections of the International Boundary and Water Commission.



Herbert H. Howell, of CAA, explains to Chairman Dewey S. Wright, of Air Transport Division, why good airports are needed by industry.

Mrs. S. Gardner Endress, of Fort Worth ASCE Wives Club, tells Local Section Conference how to organize and operate a wives auxiliary.

Here the Executive Committee of the Irrigation and Drainage Division works out its future programs. Seated, left to right, are ASCE Director Oliver W. Hartwell, Contact Member; Howard T. Critchlow; and Herbert E. Prater, secretary. Standing, in same order, are Prof. H. T. Person and Harry F. Blaney, vice-chairman.

Panelists on session on "Aims and Attitudes of Professional Development" rehearse their parts. In usual order they are G. Brooks Earnest, M. ASCE; the Rev. Robert P. Douglass, moderator; ASCE Vice-President Frank L. Weaver, who presided; Franklin E. Spafford, Dallas Bar Association; and Milford O. Rouse, M.D., president-elect, Texas Medical Association.

Conventioneers relaxed during the Western Ranch Party at Loumann's with valentines, a fiesta, and dancing. Carr Forrest, Dallas, and Burton Dwyre talk it over with Mrs. Forrest. Mrs.

John A. Focht peeks over Burton's shoulder. In upper view "Izzy" Santry and "Herb" Bartel (both professors in every-day life) sit opposite their wives at ranch-style meal.

Although Falcon Dam was built across the river in 1953 by the two governments, about 50 miles above the Lower Rio Grande Valley, extreme floods (187,000 cfs) would tax the 30,000-cfs capacity of the river channel through the valley. Interior floodways in the United States and Mexico are to be provided to take the peak flow, and Anzaldúas Dam, a $5,000,000 gated structure to be started this year (page 82), will divert peaks to these interior floodways. A second major storage dam, proposed Diablo Dam, located a mile below Devils River, is in the planning stage. There a large block of hydroelectric power can be generated and irrigation water for 80,000 acres provided.

Of broad interest were the eleven papers provided by the Pipeline Committee of the Construction Division and presented during three sessions and a luncheon. The keynote speaker for the pipeliners was L. B. Combs, M. ASCE, head of civil engineering at Rensselaer Polytechnic Institute, and Rear Admiral CEC, USN (Ret), who recommended with enthusiasm the formation of a Pipeline Division within ASCE's Technical Division frame work. Gases and liquids are being transported economically over great distances in pipelines. Rapid progress is being made in transporting solids, such as coal, ore, and paper pulp in pipes. He asked, "Is it too optimistic to predict that we will be transporting at least some of our aggregates, our cement, other building materials, grain and food stuffs by pipelines within the next 25 years?"

Speaking on the subject, "Civil Engineering in Pipelining," Stephen D. Bechtel, Jr., A. M. ASCE senior vice-president, of the Bechtel Corp., described the sequence of operations from conception to completion of a modern rapidly constructed pipeline project. Summarizing, he pointed out that in pipeline work all the following pipeline activities are recognized as appropriate functions of a civil engineer: "The economic and engineering studies; the route location; the surveys and maps; the hydraulic, structural, and foundation design; the planning, scheduling and cost estimating for construction; the management; supervision and inspection of construction; and the contract construction itself."

Something new in thickening sewage sludge before digestion is in operation at Beaumont's recently completed $2,400,000 high-rate trickling filter plant. An article based on the paper presented before the Sanitary Engineering Division by Joe Dust, superintendent of the plant, is scheduled for publication in CIVIL ENGINEERING.

"It is difficult for us in our day to realize that three-fourths of the people of the earth are still without sanitary environment, undernourished, and burdened with disease," the Convention was reminded by Herschel Engler, of the U.S. Public Health Service, International Health Division. "There are countries where the infant death rate is 500 and more per 1,000 births. In some areas one-half of the children die before they reach the age of one, and one-half the survivors die before five." He said much of this is due to water- food- and insect-borne diseases which are preventable by modern sanitation. There are cities larger than Dallas, Cleveland, and Washington without piped water supply, underground sewers, refrigeration and pasturized milk. The installation of a water system greatly assists in the development of interest in health. "The work of the sanitary engineer has done more to develop certain areas in Latin America than any other program," he said, and concluded that opportunities for engineering jobs in the World Health program are great.

The use of plastic pipes for water supply received a boost from Walter Tiedeman, of the National Science Foundation, Ann Arbor, Mich., when he reported favorable results of tests made over the past three years. Mr. Tiedeman's paper is scheduled for early publication in CIVIL ENGINEERING. Construction for both military and civilian uses is finding plastics increasingly important, their 1955 use approaching a half-billion dollars, according to Albert G. H. Dietz, M. ASCE, Chairman of the Plastics Committee at Massachusetts Institute of Technology. An article on the subject by Professor Dietz will be found in this issue.

Wide Interest in Professional Papers

Sponsored by the Department of Conditions of Practice, a panel discussion on Aims and Attitudes of Professional Development was featured at the general session on Wednesday. Participants in the panel discussion were G. Brooks Earnest, M. ASCE president of Fenn College, Cleveland; Franklin E. Spafford, past-president, Dallas Bar Association; and Dr. Milford O. Rouse, president-elect, Texas Medical Association. A lively question-and-answer session quickly cleared up several moot questions. Vice-President Frank L. Weaver presided. The views presented by the panel speakers are printed in this issue.

An afternoon session on Conditions of Practice debated the pros and cons of Local Section participation in political activities, and the desirability of sponsoring separate Junior Member organizations in Local Section areas.

For the first two days of the Convention delegates from 10 Local Sections and 25 Branches held a stimulating conference for the exchange of experiences and ideas about operating Local Sections and Branches more effectively. Frank Mirgain, of Fargo, N. Dak., chairman of the Committee on Local Sections, and Elmer Maggi, of Los Angeles, shared the responsibility of moderating the conference.

Sponsored by the Committee on Student Chapters, another stimulating and purposeful Conference brought together the Faculty Advisers of 26 of ASCE's Student Chapters for an all-day discussion on how to improve this important ASCE activity. President Needles characterized Faculty Advisers as "key men in ASCE."

Research Prizes Presented

Three research engineers were honored by the Society with awards at appropriate ceremonies which highlighted the opening session on Wednesday morning. One of the awards, first to be given by the Society, went to Dr. Lynn S. Beedle, A.M. ASCE, Lehigh University, for his experimental

Authors' Breakfasts every morning at eight (upper left) coordinated the day's technical program. Prof. Sophus Thompson, of Southern Methodist University, headed excellent technical program committee. Famous transportation men, photographed at Highway Luncheon, are (left to right in upper right photo) Thomas H. MacDonald, Hon. M. ASCE, better known as "Mr. Public Roads;" Gibb Gilchrist, Chancellor, Texas A & M College System; R. E. Dougherty, Past-President, ASCE; and Emmett H. Karrer, Chairman, Executive Committee, Highway Division.

and theoretical investigation into the fundamental nature of residual stress in structural steel. In presenting the candidate to President Needles, Elmer K. Timby, former chairman and still a member of the Research Committee, noted that "The research contribution by this investigator and his fellow workers may lead to changes or modifications of existing specifications, which will reflect greater efficiency and economy to the profession in the design of structural members."

The second award was given to Dr. Eivind Hognestad, A.M. ASCE, manager of structural development, Portland Cement Association, Chicago, in recognition of outstanding work in research on structural reinforced concrete, the results of which have contributed immeasurably to the advancement of understanding in this field of civil engineering. In presenting him Mr. Timby said, "In the search for scientific knowledge, Dr. Hognestad has displayed unusual imagination, ingenuity, skill and care in conceiving, planning, administering and executing his work. His record is one of distinguished service in the field of research."

Recipient of the third award was Philip F. Morgan, M. ASCE, professor of sanitary engineering, University of Iowa, who was honored for "developing a method of digestion of sewage sludge which materially increased the allowable loading on sewage treatment plant digestors and therefore decreased the time for digestion." He not only developed the method but also brought others into the project, trained a number of young men to use it, and made knowledge of the method available to the profession.

Student Chapter Prize Essay Contest

Special courtesies were extended to members of thirteen Student Chapters who attended the Convention. All technical and professional sessions were open to them, and they were included in invitations to the social features of the Convention. Following a well attended Student Luncheon, addressed by President Needles, the 200 assembled to hear the final run-off in a prize paper contest participated in by thirteen students, the winner in each case of a previously conducted Chapter contest. The presentations were limited to 10 minutes each. Some read a manuscript; others spoke extemporaneously from notes; still others made use of maps, lantern slides, charts and diagrams. The winner of the first prize was John Murphy, of the Chapter at the University of Texas, for a paper on "What Fire Insurance Means to the Civil Engineer." His prize was $50 and a certificate. A second and a third prize were also awarded, the winners being J. K. Woolf, of the University of Louisiana, and R. O. Wilson, of Rice Institute.

Photos by Professor Focht

To Prof. John A. Focht, veteran Texas Section member and officer, thanks are due for most of the fine photos that adorn this story.

Harnessing the Rio Grande, special responsibility of the International Boundary and Water Commission, was subject of joint papers by J. F. Friedkin and J. C. Bustamente, respectively principal engineers of U. S. and Mexican Sections of the Commission.

John N. Murphy, representing Student Chapter at University of Texas, won first place in Student Chapter paper contest.

International engineering students from Oklahoma at Student Luncheon are (seated left to right) Ghahreman Ghahreman, Teheran, Iran (Oklahoma University); Jorge C. Ponce, Manila, Philippines (Oklahoma University); Felix Wong Lopez, Venezuela (Oklahoma University); Charles Tso-lei Yen, Taipei, Taiwan (Oklahoma A & M College); and Saleh M. Owen, Tripoli, Libya (Oklahoma University). Standing, left to right, are Phanos John Theophanides, Cyprus (Oklahoma A & M College); Hoang-Ngoc-Than, Saigon, Vietnam, (Oklahoma University); Dominador M. Apalisok, Philippines (Oklahoma University); Chumbhol Rugpratum, Bangkok, Thailand (Oklahoma University); and Praphorn Charuchandr, Bangkok, (Oklahoma University).

Dallas Actions of Board of Direction Briefed

The Board of Direction met February 13 and 14 in the Baker Hotel in Dallas, Tex. Principal actions taken by the Board are briefed below:

Technical Division Contact Members

The Board initiated action on a previously discussed plan to provide a contact member from the Board for each Technical Division.

Convention Dates Set

With the willing consent of the Cleveland Section, the Spring Convention of 1957, originally set for Cleveland, was transferred to Buffalo for the dates of June 3–7, 1957. The change was made to permit featuring inspection of the St. Lawrence River Project during its most interesting construction phase. The Board acted at the same time to designate Cleveland for a Convention during May of 1959.

Washington, D.C., was selected for the Annual Convention to be held in October of 1959.

Biennial Directory (Membership Listing)

An order blank is to be placed in the hands of each member to permit him to order more conveniently the biennial Directory (list of members).

Registration in Canal Zone

The Board acted to endorse federal legislation for the registration of engineers in the Panama Canal Zone.

Joint Task Committee Expanded

It was voted to expand the ASCE-ASME task committee on the preparation of a joint manual of professional engineering practice to include the American Institute of Consulting Engineers.

Faculty Adviser Conferences

Conferences of Student Chapter Faculty Advisers were authorized to be held at the Pittsburgh, Pa., Convention in October 1956, and at the Jackson, Miss., Convention in February 1957.

Engineers in Civil Service

On recommendation of the Task Committee on Engineers in Civil Service, the Board acted to endorse federal legislation to make a long-range study of the classification of and basic rates of compensation for technical, scientific, and engineering positions in classified Civil Service and to support generally proposed legislation which would raise the top salary of Grade GS-17 to at least $16,500 per annum with consistent minimum and intermediate salary levels, and would liberalize the present retirement system.

Pollution Control Legislation

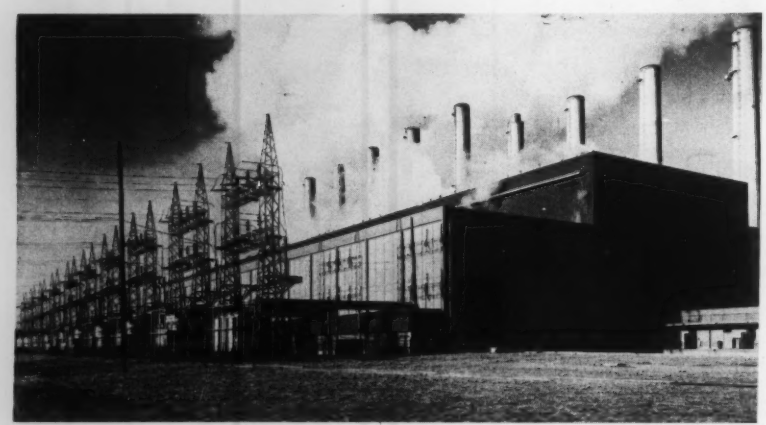
On recommendation of the Executive Committee of the Sanitary Engineering Division, the Board acted to endorse the renewal of federal legislation which would assure continuance and improvement of the stream pollution control program. The existing law expires on June 30, 1956.

EJC Membership Expanded

The Board voted to approve admission of the American Society of Agricultural Engineers as an associate member society of Engineers Joint Council.

Knoxville Convention Is Next

Knoxville, Tenn., the gateway to the Great Smoky Mountains, will be the locale of the Society's 1956 Spring Convention, June 4–8, to which the Tennessee Valley Section will be host. This fast-growing metropolis promises Convention visitors a happy combination of technical and recreational activities. The city dates back to 1791 when William Blount signed the Treaty of the Holston, giving the white settlers title to the lands from the Cherokee Indians. A year later the Blount Mansion, now a museum, was built, and in 1794 Blount College was chartered by the territorial legislature. The college became the University of Tennessee, on whose campus the Knoxville Convention meetings will be held.



Kingston Steam Plant at Kingston, Tenn., with capacity of 1,600,000 kw, is largest in the world. Last unit went into operation early in December 1955. Inspection trip to this plant is scheduled for June 8 for visitors to the Knoxville Convention.

Despite the rapid development of the area since the inception of the TVA and, more recently, the Atomic Energy Commission program at Oak Ridge, the folklore of the region continues to live in the hillbilly songs and costumes, mountain handicraft, and in such picturesque customs as the horse-borne highland country doctor with his medicines carried in a saddle-poke. The Entertainment Committee is capturing some of this atmosphere in a program of folk music and square dancing, scheduled for the University Center on Wednesday evening. For lovers of the theater there will be a special Thursday evening performance of a Broadway play in the Carousel Theater—a joint university-community project and one of the popular theaters-in-the-round.

Friday, June 8, has been set aside for inspection trips to the interesting projects that abound in the area. On the agenda are: (1) the Oak Ridge National Laboratory, including the graphite and "swimming pool" reactors and the high-voltage laboratory, followed by a visit to the Museum of Atomic Energy; (2) the Kingston Steam Plant, largest in the world and now in full operation; and (3) Norris Dam and the TVA Hydraulic Laboratory. At the laboratory tests are being made on models of the new Wilson Dam lock, which will have the highest lift in the world. An

additional trip on Saturday—to TVA's Fontana Dam and the Aluminum Company of America's Cheoah, Calderwood, and Chilhowee dams—will be particularly interesting to persons attending the symposium on arch dams.

Special events for the ladies will include a trip into the Great Smoky Mountains and to the Gatlinburg craft shops; brunch and a style show at one of the South's newest and smartest department stores; a visit to Blount Mansion; and tea at an antique shop, which is set up as a complete home. All inspection trips except to the Oak Ridge National Laboratory will be open to the ladies. If weather records for the past eighteen years are any indication, the chances for good weather in the Knoxville-Gatlinburg area during the Convention are two-to-one.

Session on Multiple-Purpose River Development

One of the Convention highlights will be a general Wednesday afternoon session on multiple-purpose river development. The Tennessee Valley represents one of the world's most outstanding developments of this type, and C. E. Blee, chief engineer of the TVA, has been appropriately chosen as chairman of the symposium. TVA experiences will be reported by several officials of the agency, and the future of multiple-purpose river development will be discussed by other speakers, from the points of view of the Corps of Engineers, the Bureau of Reclamation, and engineers in private practice. The Department of Conditions of Practice is arranging an interesting program for Wednesday morning under the chairmanship of Vice-President Weaver.

Twenty-Seven Technical Sessions

The symposium on arch dams—a five-session program under sponsorship of the Power Division—will feature papers by authorities from France, Italy, Japan, and Portugal as well as the United States. Among the papers scheduled for the four Hydraulics Division sessions are two on different phases of the unique thermal density condenser cooling water supply at the Kingston Steam Plant. In all, twenty-seven technical sessions covering every phase of civil engineering are planned.

Don H. Mattern is general chairman of the Convention Committee in charge of plans. The entire program will be printed in the April issue.

Knoxville Structural Division Program to Be "Different"

A somewhat different type of program—one modeled after the technical-type conference—is being scheduled for the Structural Division at the Society's forthcoming Knoxville Convention. The larger attendance at technical conferences, held separate from Conventions and limited to a single area of interest, has suggested the possibility of increasing Convention attendance by placing greater emphasis on strictly technical papers and less on project descriptions, even though the latter may be of high caliber.

Of the four Structural Division sessions, one will be devoted exclusively to ultimate strength design, one to shell structures, and one to prestressed concrete. These sessions have been planned to give the profession practical knowledge of design progress, developments, and techniques in these rapidly growing areas of reinforced concrete design and construction. Papers by engineers intimately connected with developments in the respective fields will highlight these sessions.

The opening session, Tuesday morning, June 5, will be devoted to interesting design features of three specific types of structures—large steam plant powerhouses, a tall office building, and an unusual tower. The speakers, an all Tennessee panel, will be Ernest M. Titus, M. ASCE, assistant head structural engineer for the TVA; Ross H. Bryan, M. ASCE, consulting engineer of Nashville; and Gibson Morris, chief engineer of the Oak Ridge National Laboratories. Prof. A. T. Granger, of the University of Tennessee and chairman of the Sessions Program Committee, will preside at the first session.

At the session on ultimate strength design, Thursday morning, June 7, Eivind Hognestad, A.M. ASCE, manager, Structural Development Section, Research and Development Division, Portland Cement Association, will review investigations, both here and abroad, which confirm the inelastic stress distribution in concrete. Raymond C. Reese, M. ASCE, consulting engineer of Toledo, Ohio, will interpret the recommendations for ultimate strength design as related to present practice. Phil M. Ferguson, M. ASCE, chairman of the department of civil engineering at the University of Texas, will illustrate how ultimate strength procedures simplify design. Finally the application and practical advantages of ultimate strength design will be discussed by Charles S. Whitney, M. ASCE, consulting engineer of Milwaukee. Leo H. Corning, M. ASCE, of the Executive Committee of the Structural Division, will preside.

A discussion of the physical behavior of shell structures will lead off the Thursday afternoon session. Other papers will cover the economic considerations in the design and construction of shells, ribless shells as contrasted with conventional-type shell design, and design features of hyperbolic-paraboloids and other shells of double curvature. Speakers for this session will be W. Worthington Ewell, J.M. ASCE, consulting engineer of Baltimore; Boyd G. Anderson, associate partner, Ammann and Whitney, New York; Anton Tedesko, M. ASCE, manager, Roberts and Schaefer Co., N.Y.; and Alfred L. Parme, A.M. ASCE, Portland Cement Association, Chicago. Presiding will be Robert F. Blanks, M. ASCE, chairman of the Committee

Hard at work planning Structural Division program are (seated, left to right) Elmer Timby, Maurice Quade John, Rinne, and chairman, Ernest Hartmann. Standing, in same order, are Leo Corning, Harold T. Larsen, and Prof. Warren Raeder.

on Masonry and Reinforced Concrete.

In the final session, Friday morning, papers will be presented on important phases of prestressed concrete. E. L. Erickson, chief of the Bridge Branch, Bureau of Public Roads, Washington, will discuss the selection of factors in criteria for prestressed concrete bridges now being used extensively in the design of highway bridges. Friction in the post-tensioning process—its significance, sources, and how to reduce friction losses—will be discussed by T. Y. Lin, M. ASCE, professor of civil engineering, University of California. The results of an investigation of the ultimate shear resistance of prestressed beams and design procedures will be presented by Prof. E. M. Zwoyer, J.M. ASCE. of the University of New Mexico. The program will be concluded by Jean Muller, of the Société Technique Pour L'Utilisation de la Precontrainte, Paris, who will present test data and the determination of ultimate capacity of continuous prestressed members. Ernest C. Hartmann, M. ASCE, chairman of the Executive Committee of the Structural Division, will preside.

Engineering Manpower to Fore at EJC Assembly

Some 500 engineers from all branches of the profession gathered for the second General Assembly of Engineers Joint Council at the Hotel Statler in New York, January 26 and 27, to discuss the most pressing problems facing the profession today. The sessions covered engineering manpower, the use of technicians to supplement our limited supply of trained engineers, the professional development of the engineer in the course of his career, and the engineering aspects of the Hoover Commission Report. Particularly informative was a discussion of President Eisenhower's reserve program in the light of present conditions and future international peril.

Speaking on the Reserve Forces Act of 1955, Albert Kay, director of manpower and manpower supply in the Office of the Assistant Secretary of Defense, emphasized the need of support in all phases of the program so that, "from a position of realistic and ready strength we may win the peace without the necessity of having to win a war."

Brig. Gen. Carlton S. Dargusch, assistant director for manpower of the Office of Defense Mobilization, pointed out that the major responsibility of the ODM will be to review, from time to time, the operations of those parts of Public Law 305 affecting the needed proper balance between civilian and military manpower requirements. He emphasized that, "Since we cannot in any event hope to match the Soviet and its satellites in numbers of men, we must therefore top them in the training, allocation, and utilization of specialists such as scientists and engineers."

Our Brain-Power Resources Studied

Addressing a luncheon meeting on the subject, "Brain-Power Our Greatest Asset, Frank H. Bowles, director of the College Entrance Examinations Board, stated that the results of a recent study made by the College Entrance Examination Board of the undeveloped brainpower in the United States, lead to two conclusions: (1) the brain-power group is not large, and (2) the number of students of high ability graduating from college cannot under present circumstances be increased greatly. "From these facts it is clear," Mr. Bowles said, "that no great quantity of salvation is to be expected from efforts to stimulate the output of educated brainpower through such devices as scholarship programs. There will be some results of course but they will not be startling nor, except for huge sums of money, numerically important."

Better Utilization of Our Scientific Manpower

One solution proposed for the better utilization of our engineering manpower is the upgrading of qualified and trained engineers and the assignment of subprofessional functions to technicians. In an afternoon session devoted to this subject Donald Rollins, vice-president of engineering for the American Bridge Division of the U.S. Steel Corp., noted that by maximum use of technicians and maximum use of electronic machines, about 10,000 man-hours were saved on the calculation of erection and cable stresses in a recently completed suspension bridge. His company also found it advantageous to use experienced technicians to check and train junior engineers. Its experience has been that the proper balance of technicians to engineers is about two to one. Speakers from other major industries confirmed this ratio.

Geared closely to the upgrading of engineers to make maximum use of our limited engineering manpower is the second problem of developing the engineering capacity of the individual to its fullest potential. From the educator's viewpoint, Morrough P. O'Brien, dean of engineering at the University of California, noted that, "Managers have the authority but not the knowledge. The specialists have the knowledge but not the authority. The problem is to achieve somehow in a large technical organization a merger of knowledge and authority." Dean O'Brien further stated that, in his opinion, the solution lies in a "more realistic educational preparation prior to professional practice and subsequent periods of relatively intensive education throughout the professional career." He added that, "There is as much reason to set up advance programs in engineering as in business. But industry now sends many senior executives to graduate business schools and almost none to engineering."

In another paper in this session devoted to the development of the full potential of our engineering manpower, James H. Taylor, director of industrial relations for Procter and Gamble, suggested that to overcome the natural and organizational inhibiters to the professional growth of the engineer, it will be necessary to develop progression levels so that "men of equal ability and performance advance equally with respect to position, pay, honor, responsibility, and recognition."

On the subject of the quest for professional status, Earl Brunner, New York management consultant, divided status into five categories—namely, title, social regard, material reward, scientific regard, and cultural sensitivity. He noted that four of these five attributes come from outside the individual. Only cultural sensitivity is a personal attribute. Mr. Brunner stated that development of status in the first four categories can be enhanced mainly through performance and by indirect approach through development of the art of communication with those outside the profession so that our accomplishments may be better understood.

Hoover Report Discussed

Final sessions of the general assembly were devoted to aspects of the Hoover Commission Report and to the development of atomic power. Speaking at a luncheon S.C. Hollister, dean of engineering at Cornell University, stated that "in

effect the government is busy actively promoting killing the goose that lays the golden eggs." Pointing to the sheer bigness of government operations, Dean Hollister said, "It has resulted in inadequate accounting, lack of inventory, wide confusion, hidden subsidies, conflict of objectives, and the attendant duplication and waste." He concluded that none of the recommendations of the Hoover Commission will be carried out if the citizens of the country sit on the side lines.

"We have the biggest and most expensive government in the world. We are on trial to see whether we can make it effective without its becoming our master." This is what Rear Admiral Ben Moreell, chairman of the board of Jones & Laughlin, told the group in a talk on the work of the Task Force on Water Resources and Power of the Second Hoover Commission. He stated that huge losses in federal revenue result from below-cost power sales and apparent commitment of precious water to uneconomical and wasteful uses.

Atomic Power a Crying Need

In the featured talk at the dinner meeting Walker L. Cisler, president of the Detroit Edison Co., attempted to evaluate the usefulness of nuclear power from a world viewpoint. In his opinion the principal reason for the world-wide interest in atomic energy is simply the fact that "the world is becoming more and more energy conscious. . . . and that the world today thinks of human progress and the utilization of energy as going hand in hand." As was pointed out at the Geneva Conference, Mr. Cisler reminded his audience, "we will need to double the world output of electric and other forms of power by 1975 and more than double it again by the year 2000. This is more than conventional fuels can provide without increasing costs to extremely high levels." For the first time, he added, "people of the under-developed areas see the possibility of equalizing costs of electric power throughout the world. Distances will no longer be a factor when *pounds* rather than *thousands of tons* will supply the fuels for power generation."

J. Waldo Smith Hydraulic Fellowship Increased

By order of the Board of Direction, the J. Waldo Smith Fellowship has been increased from $1,000 to $1,500, plus as much more up to $500, as may be required for physical equipment connected with the research. To provide the increased sum, the award will be offered every three years instead of annually.

Competition for the next award will be announced in CIVIL ENGINEERING for October 1956, and closed May 1, 1957. The successful candidate will be announced after the Society's June Convention in that year, enabling him to begin his program of work the following September.

Mead Prize Contest Is in Full Swing

Junior Members and students are reminded that the annual competition for the Daniel W. Mead Prizes on Ethics is in full swing. It will be remembered that the Board of Direction has doubled the amount of the prizes (April 1955 issue, page 67). The student award is now $50, and the Junior Member award $100. The rules for the contest are given in the 1956 Official Register (page 136).

As announced earlier, Junior Members will write on "Responsibilities of the Architectural Firm and the Engineering Firm on a Cooperative Undertaking," and the student subject will be "Ethics of the Senior in Making Commitments with Prospective Employers." To be eligible, all manuscripts must be in the hands of the Executive Secretary of ASCE before May 1, 1956.

ESPS Celebrates Thirty Years in San Francisco

The San Francisco office of the Engineering Societies Personnel Service is receiving congratulations on its thirtieth anniversary from the engineering societies that cooperate in sponsoring ESPS. In its thirty years of service to engineers of the Western states, the San Francisco office has been instrumental in filling 8,000 engineering position—2,500 of them civil engineering positions in construction, government, consulting and other fields.

ASCE members of the San Francisco Section who have served on the local advisory committee include Fred H. Fowler, T. H. Means, Ralph A. Tudor, T. A. Corwin, C. W. Appleford, D. D. Leslie, and H. M. Engle. Serving at present is Walter L. Dickey, chief structural and civil engineer for the Bechtel Corp. William H. Wisely, Executive Secretary of ASCE, and John A. Zecca, comptroller, represent ASCE on the Board of Directors for ESPS.

Amendment of Code of Ethics Approved

On the recommendation of the Committee on Professional Practice, the Board of Direction recently submitted to a referendum of the membership a proposal for amending Article 4 of the Code of Ethics (December issue, page 69). As amended by letter ballot, Article 4 now reads:

"It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers to invite proposals for the performance of professional engineering services or to state a price for such services in response to any such invitations when there are reasonable grounds for belief that price will be the prime consideration in the selection of the engineer.

The tellers appointed to count the ballots on amendment of the Code of Ethics on February 7 report as follows:

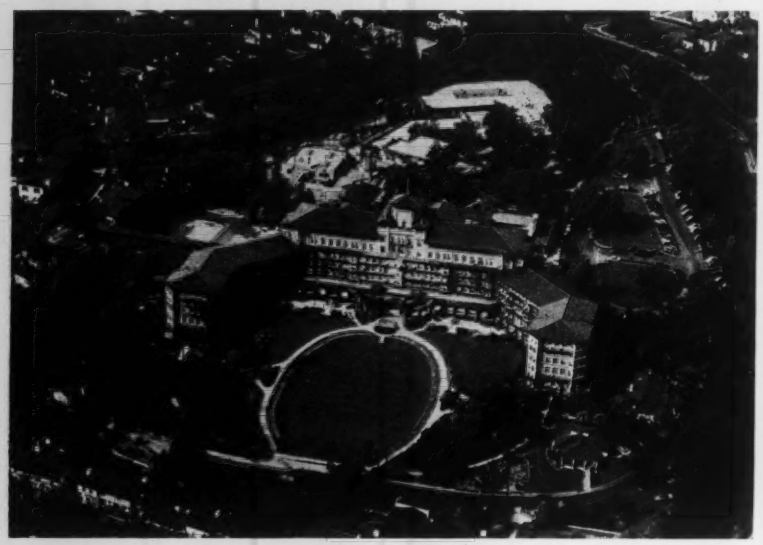
Total number of ballots received		14,082
Ballots excluded from the count:		
Without signature	39	
Total ballots not counted		39
Total ballots counted		14,043
Yes	12,443	
No	1,554	
Blank	46	
Void	0	
Total	14,043	
(*a*) Total votes counted (yes and no)	13,997	
Required to carry (one-half of (*a*))	6,999	
Carried by	5,444	

Respectfully submitted,
Albert P. Loriot, *Chairman*

Bruce I. Auerbach
Austin E. Brant, Jr.
John J. Fruin
Anthon J. Galioto
James P. Jeffers
William A. Wolter
Tellers

February 2, 1956

Pacific Southwest Conference to Be Held in Pasadena



© Goodyear Airship - Kopac photo

Huntington-Sheraton Hotel in Pasadena—headquarters of the ninth annual conference of the Pacific Southwest Council, April 19–21—is convenient to all the traditional Southern California attractions.

With the Los Angeles Section as host and Sterling S. Green as general chairman, the ninth annual conference of the Pacific Southwest Council will be held in Pasadena, Calif., April 19–21. An outgrowth of the California Conference, the present Council now includes the Arizona and Intermountain Sections as well as the four California Sections (Los Angeles, Sacramento, San Diego, and San Francisco). The Student Chapters in the area are also represented in the Council, and the University of Southern California and the California Institute of Technology Chapters will be the student hosts. The annual student paper competition will be run off Friday morning, April 20 (the contestants to be chosen as usual in preliminary Section contests).

To get away from the pattern of national Conventions, this year's conference will minimize the technical program and give greater emphasis to professional matters. Thursday afternoon, April 19, Junior Forum representatives of the California Sections will conduct a panel discussion aimed at answering the question, "What Does the Engineer Want?" Arthur E. Bruington, associate civil engineer of the Los Angeles County Flood Control District, will moderate the session, which will present the viewpoints of Civil Service, of consulting engineering, and of industry.

Legislation affecting engineers will be discussed at the opening session (on Thursday morning) by Anthony Kennedy, legislative counsel for the California Legislative Council of Professional Engineers, and Phil Helsley, owner-manager of the San Diego Testing Laboratory. E. P. Lange, secretary of Engineers Joint Council, will be present from New York to address the same session on "Local Sections and Engineers Joint Council." The final professional subject slated for study is registration of civil engineers, which will be discussed Friday afternoon. Two members of the California Board of Registration—L. M. K. Boelter, dean of the U.C.L.A College of Engineering, and S. B. Barnes, consulting structural engineer of Los Angeles—will discuss registration as a technical and professional asset in this session.

The technical program will include a timely paper on "Control of Floods from Torrential Storms," by Luther Windsor, Salt Lake City consultant, scheduled for Friday. Thursday, S. T. Harding, San Francisco consultant, will talk on "Water Rights and the Proposed State Water Plan." Following his talk, Robert R. Shoemaker, chief harbor engineer for the Port of Long Beach, will describe the Long Beach Harbor field trip scheduled for Saturday morning. The other technical paper is being prepared by Wayne O'Harra, engineer of materials for the Arizona Highway Department, and will deal with highway engineering computations by electronic computers. In addition to the Long Beach Harbor trip, visits are being arranged to the Kaiser steel mill at Fontana and the Etiwanda Steam Plant of the Southern California Edison Co.

Important outside speakers already lined up include ASCE President Enoch Needles, who will address the Thursday noon luncheon. A ladies' program geared to the conference pace will assure distaff visitors an interesting three days, too. The ASCE Executive Committee will meet during the conference.

Coming Events

Los Angeles—Host to the Pacific Southwest Council Conference at the Huntington-Sheraton Hotel, Pasadena, April 19–21. Sterling S. Green is general chairman.

Metropolitan—Dinner meeting at the Statler Hotel, March 21, at 7 p.m. A cocktail hour will precede the meeting.

Hawaii—Annual conference at the Princess Kaiulani Hotel, Honolulu, April 24.

Mid-South—Spring meeting at the Lafayette Hotel, Little Rock, with the Little Rock Branch as host, April 26–28. The Little Rock Branch will have a dinner meeting at Granoff's Restaurant the third Wednesday of every month, except April, August, and December.

New Mexico—Joint spring meeting with the El Paso Branch of the Texas Section at El Paso, April 6 and 7.

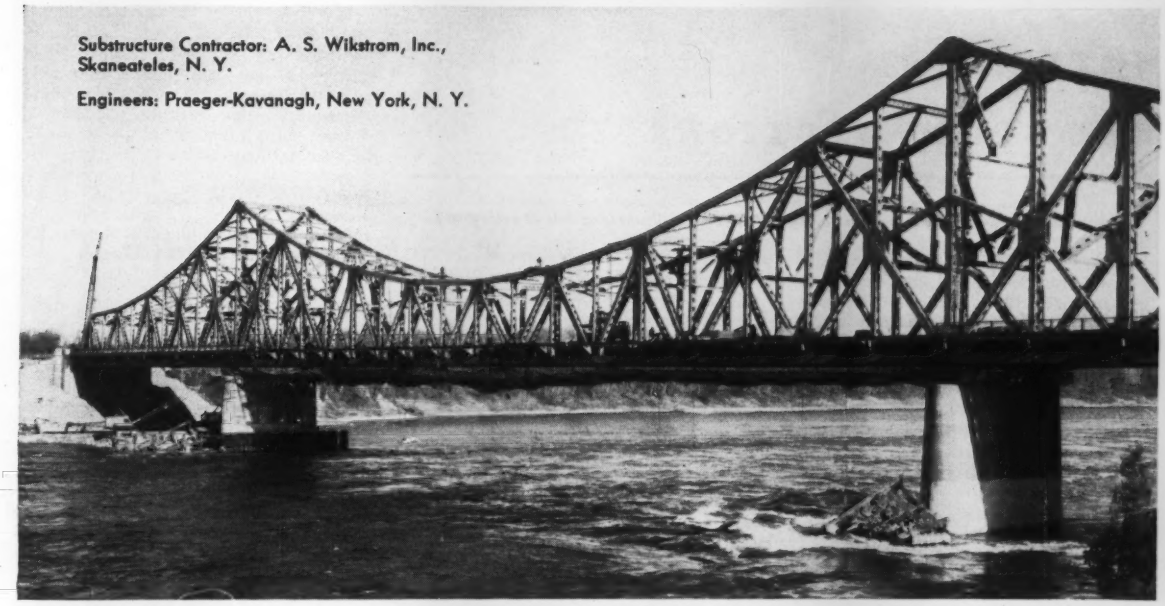
Providence—Host to the third Regional Conference of the New England Council at Brown University, Providence, April 71

Spokane—Joint meeting with the ASTM Friday evening, March 23 (time and place to be announced later).

Wisconsin—Meeting to discuss Mackinac Straits Bridge on March 29 (time and place to be announced later).

ASCE MEMBERSHIP AS OF FEBRUARY 9, 1956

Members	9,112
Associate Members	11,710
Junior Members	17,654
Affiliates	70
Honorary Members	41
Total	38,587
(February 9, 1955)	38,064)

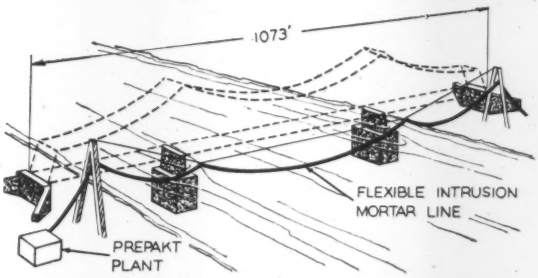


Substructure Contractor: A. S. Wikstrom, Inc., Skaneateles, N. Y.

Engineers: Praeger-Kavanagh, New York, N. Y.

At St. Lawrence Power Project the $5-million Barnhart Island Bridge [above] was built under tough, hazardous conditions. Here's . . .

How Bridge Builder Licked 16-mile current, 14-month deadline



Valuable time and cost of a second plant set-up were saved by pumping all INTRUSION mortar for 13,500 cu. yds. of PREPAKT concrete from one plant on U.S. mainland. To reach north abutment an 1100-foot line was hung across river.

In building the substructure for the Barnhart Island Bridge, the contractor had to fight a destructive 16 mph river flow and an almost impossible schedule. The 1073-foot continuous-truss bridge provides access to the Power Plant and Long Sault Dam on the island—heart of the St. Lawrence Power Development Project.

Use of the PREPAKT method for placing all concrete in the bridge contributed to the project's success. Speed, flexibility of operation and high quality underwater concrete resulted from the PREPAKT technique of consolidating preplaced aggregate with INTRUSION mortar.

Specifications allowed PREPAKT concrete in underwater portions, but the contractor was permitted to use it for the entire substructure. This allowed speedy placement of coarse aggregate directly into cofferdams from cranes working on dikes. All INTRUSION mortar for both piers and both abutments, the remainder of the concrete, was mixed and pumped from a single, shore-based PREPAKT plant. A flexible pumping line avoided time-consuming relocation of the plant.

The fast, simplified placement of PREPAKT concrete under difficult conditions is one of the many advantages of this method.

Prepakt maintains a complete field construction organization plus an engineering service, and functions as prime or subcontractor. For further information, write: Intrusion-Prepakt, Inc., Room 779-H, Union Commerce Building, Cleveland.

Intrusion and *Prepakt* are trade marks of Intrusion-Prepakt, Inc., whose methods and materials are covered by U. S. Patents Nos. 2313110, 2655004, 2434302 and others, also patents pending.

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NOTES FROM THE LOCAL SECTIONS

(Copy for these columns must be received by the tenth of the month preceding date of publication.)

New **Akron Section** officers—elected at the January 19 dinner meeting—are William R. Wagoner, president, and William R. Ruhlin, vice-president. W. B. Logan, of Wooster College, was featured speaker.

The **Central Illinois Section's** two new life members—Robert F. Fisher and Harvey H. Jordan—were honored at the Section's annual Ladies' Night on January 11. Guest speaker G. C. McVittie, head of the astronomy department at the University of Illinois, gave an enlightening talk on astronomy and what astronomers do.

The Franki method of placing foundations was described in the leading talk at the January meeting of the **Central Ohio Section** by Leon A. Fraikin, president of the Franki Foundation Co., of New York City. The method involves the use of displacement caissons or pressure-injected footings.

Application of analog and digital computers to civil engineering problems is a distinct possibility, engineers attending the **Cincinnati Section's** January meeting were told. The speakers were C. W. Falk, of the aero-physics department of the Goodyear Aircraft Corp., and N. M. Newmark, research professor of structural engineering at the University of Illinois.

About 80 percent of all civil engineers are employed on "public work," in the sense of "projects, public and private, which are for the use and benefit of mankind," ASCE President Enoch R. Needles said in the featured talk at the **Cleveland Section's** meeting on January 20. Discussing the relationship of engineering education to the civil engineer, Colonel Needles said that the civil engineering curriculum should be specifically designed for the civil engineer and that it need not include electronics, atomic fission physics, and the like, but rather "basic civil engineering subjects to give the student a sound background." He also favors extending the civil engineering course to five or six years and more attention to the humanities. In the annual election of officers, John B. Scalzi was chosen president; John C. King, vice-president; and Michael J. Phillips, secretary.

For the **Connecticut Section** the new slate is Arthur W. Sweeton, III, president; William S. Kaminski, vice-president; and Earl R. Howard, secretary-treasurer. President Needles attended the Section's January meeting and presented life membership certificates to three of its members—Thomas Fraher, George A. Sallans, and Claude T. Wilson. Honored in absentia was Carl H. Sorensen, now living in Savannah, Ga.

Modern methods of training personnel was the timely topic at a recent dinner meeting of the **Duluth Section's Iron Range Branch.** R. Michels, Jr., assistant construction engineer for the Taconite Construction Corp., was featured speaker. Unanimously elected to office during the session were Henry Schmidt, president; John Ekman, vice-president; and Steve Surman, secretary-treasurer.

High blast temperatures of jet planes and the heavy loads carried by today's cargo planes necessitate redesign of airbase landing strips, according to Monte R. McFarland, paving engineer for the Corps of Engineers at Atlanta. In the featured talk at the **Georgia Section's** February meeting, Mr. McFarland discussed the advancements in pavement design needed to cope with the damaging effects of such aircraft. Brig. Gen. Henry J. Hoeffer, division engineer of the Corps of Engineers, was guest of honor.

The **Hawaii Section** is graciously inviting any and all ASCE members, who can make the trip, to its 1956 annual conference, scheduled for Tuesday, April 24. The Robert Louis Stevenson Suite at the top of the beautiful new Princess Kaiulani Hotel in Honolulu will be headquarters for the all-day affair, which will begin with breakfast and end with a banquet. The technical sessions will be built around the general topic of highway engineering. Featured speakers will include Ben E. Nutter, superintendent of public works for the Territory of Hawaii, and President Needles and Executive Secretary Wisely from New York. Program Chairman Russell L. Smith, Jr., will answer inquiries addressed to him at Room 502, 850 Richards Street, Honolulu, Hawaii.

Lehigh Valley Section members awarded life membership certificates at a recent Section meeting in Allentown were Ethan Ball and Frederick Waddell, both of the Bethlehem Steel Co. During the business meeting Richard Van Vliet, of Allentown, was elected president; Rollin Foster and Robert DeMoyer, vice-presidents; and Donald Werley, secretary-treasurer. In the leading talk on flood control on the Delaware and Lehigh rivers, George R. Jenkins, professor of geology at Lehigh University, advocated coordination of two proposed and much-argued programs —the Army Engineers' proposal for control by means of big dams and the soil conservationists' program emphasizing land control by contour farming and forest expansion—as the best flood control solution.

At its first official meeting, held at Montpelier, the newly created **Vermont Branch** of the **Maine Section** elected its 1956 officers—Louis M. Laushey, president; Reginald V. Millbank, vice-president; and Stephen C. Knight, Jr., secretary-treasurer. Executive Secretary Wisely was guest speaker and talked about the Society. There were about forty present. The many facets of office and field research that must precede actual design of bridges and highways were covered at the second annual New Hampshire Highway Conference, held at Durham, December 16, with the Section's **New Hampshire Branch** and the University of New Hampshire as sponsors. In January the Branch took part in a joint meeting with other engineers

ASCE President Enoch R. Needles, guest of honor and principal speaker at January 20 meeting of Cleveland Section, chats with G. Brooks Earnest (left), former Vice-President, Zone III; and retiring Section President William B. Auping.

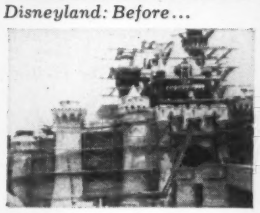
The Surveyor's Notebook

Reporting on Unusual Surveying Problems and Their Solutions

Notekeeper: W. & L. E. Gurley, America's Oldest Engineering Instrument Maker

How Disney's Magic Kingdom Grew in an Orange Grove

Disneyland: Before...



...During...

...After

"When we first started work on Disneyland—just about one year before it opened—it was a 160-acre orange grove," recalls Donald J. Hallgren, Walt Disney's Field Engineer on the job. "McNeil Construction Company, Los Angeles, furnished all the necessary equipment, men and materials; Disneyland, Inc. furnished plans, specifications and the engineering personnel.

"This is where I came in as coordinator between plans and building phases of the job. My job was to coordinate the survey, staking, etc., necessary to keep the prime contractor's crews of carpenters, electricians and earthmovers busy.

"Imagine an orange grove with a tree every 25 feet, and you'll see our problem. Out of this grove was constructed a half-mile long river, six feet deep and averaging 200 feet wide along its winding course, with waterfalls, sandbars, docks and drydock for a real paddle boat. (This boat, like everything else in the park, was built 5/8ths scale.) Another river was built one-quarter of a mile long, depicting any jungle in the world, complete with mechanical moving animals. It would take a small volume to detail the unusual problems and angles we encountered.

"Without the excellent work turned in by our survey parties, this job could never have been completed on time. During grading operations for our 100-acre parking lot, for instance, earthmovers needed grid and grade stakes on every 50-foot square. I would have one party doing nothing else but running lines and driving lath and flats, and two more crews following them, reading and marking the cuts and fills. As fast as my men drove the stakes, the equipment would cut and fill around them. I sincerely believe that, at one time or another, every square foot of that 160 acres has had a two-inch-by-two-inch hub driven in it for one reason or another.

"Imagine the strain on my crews—to be just starting a layout for a building, have all control run and to be getting ready to run line, and then have me drive up and move them over to some still higher-priority job. With all this confusion, there was one thing we could *always* count on. That was the precision and rugged nature of our Gurley instruments, which never let us down in a jam.

"Now, watching all the children at Disneyland having such a great time in their magic kingdom, it is difficult to remember the hectic side of those construction days. Let's just say: 'Never was so much done, in such a short time, by so many!'"

"Surveyor's Notebook" Tips

Can you use these field aids? Gurley can supply 50-pound test yellow nylon plumb bob cord, to add to the visibility of your string in poor lighting. Also a cord adjustor, which helps you make quick changes in line length in the field. Send 25 cents in stamps or coin for a set of cord and adjustor with a drawing showing how to use them.

* * *

Change your magnification to suit weather and light conditions. It's possible with *Variable Power*—now standard on all Gurley transits and levels. "VP" permits wide range of magnification with *one* eyepiece. Built-in haze filter. Write for "Facts on VP".

NEW EDITION OF "SURVEYOR'S NOTEBOOK": We have collected the most helpful, most discussed pages from Series One and Two of "The Surveyor's Notebook" in one 20-page book. These valuable field tips will help you use your own instruments with greater success. *Write for your free copy.*

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Photographed at Maryland Section's January meeting are (front row, left to right) Past-presidents George A. Carter and William B. Spencer; Guest Speaker Henry A. Barnes, director of the Baltimore Traffic Engineering Department; and Section President W. Watters Pagon. In rear row are Secretary-treasurer W. W. Ewell; Guests Victor W. Buhr and Charles W. Hetzer; and Section Vice-President Charles L. Kroll.

In Pittsburgh for dinner meeting of the Pittsburgh Section ASCE President Enoch R. Needles and Executive Secretary Wisely meet Mayor David L. Lawrence (seated between them) while on tour of the Pittsburgh area conducted by Section officers. Standing are Dr. Elio D'Appolonia (left), Section president for 1956, and 1955 president, Charles M. Wellons. Almost 200 Section and Student Chapter members attended the dinner, which featured a talk by President Needles and presentation of life membership certificates. The new life members are Emil E. Appel, Willard H. Buente, Charles W. Doerr, James P. Growdon, Howard P. McKown, Ernest S. Taylor, and Harold A. Thomas.

architects, and contractors, at which Ray M. Boynton, from the office of D. B. Steinman, spoke on design and construction of the Mackinac Straits Bridge. The attendance of over 250 made the meeting the biggest gathering on record of New Hampshire engineers.

Principal speaker at the **Maryland Section's** January 11 meeting was Henry A. Barnes, director of the Baltimore Traffic Engineering Department. Discussing automatic traffic control, with specific reference to Baltimore, Mr. Barnes emphasized that traffic lights cannot solve traffic problems unless they are coordinated with the overall traffic pattern. Baltimore is now installing an electronically adjusting signal system at over 365 intersections, but it will be several years before the changeover from pre-set interval lights will be completed. Mr. Barnes said that the cost to the city will be about $1,000,000.

The Michigan Section will be host to the District 7 Conference in August. The place will be Detroit, and the dates the 10th and 11th. Prof. John C. Kohl will be conference chairman.

Members of the **Mohawk-Section** have voted to affiliate with the District 3 Council of Sections. Delegates to the Council for 1956 will be Section President Gordon Ayer and Past-President J. Sterling Kinney.

To bring home the importance of a sound national highway program to Montana, the **Montana Section** is sponsoring six meetings that will cover the whole state. Meeting times and places are being arranged by the Branches. Henry Helland, member of the Section and assistant state highway engineer, will be present at all the meetings to explain the program. New **North Montana Branch** officers, elected on January 22, are Leland J. Walker, president; William J. Wenzel, vice-president; and George J. Hoge, secretary-treasurer. City-wide paving and storm sewer projects in the works for Great Falls were described in the featured talk by William F. Wendland, project engineer for Harold Hoskins and Associates, the engineers.

In the **Nashville Section** the 1956 slate is Donald C. A. duPlantier, president; Christopher G. Hopkins, vice-president; and Daniel B. Barge, Jr., secretary-treasurer. Henry Akin, a new member of the Section, is taking over as editor of the Section's flourishing newsletter, "A Level Line," which is beginning its third year. Wilbur Sensing, Jr., is retiring as editor after rendering valuable service to the Section in the post.

The importance of keeping up the United States' ever-increasing physical plant was highlighted in an "engineering in maintenance" program put on by the **National Capital Section** in January. Oscar W. Graveley, director of maintenance for the Department of Defense, told what the government wants from engineers in the way of maintenance; J. E. Gahagan, chief engineer for the Ansco Division of the General Aniline and Film Corp., explained the needs of industry; Emil H. Praeger, New York City consultant, reviewed the whole role of the engineer in the field, and E. J. Peltier, assistant chief of the Bureau of Yards and Docks for maintenance and material, discussed in detail the engineering maintenance program in operation at Navy shore establishments.

When the special requirements of the huge, $14 million Army Finance Center emerged from planning, reinforced concrete was selected by the Corps of Engineers, U. S. Army, as the best method of structural framing.

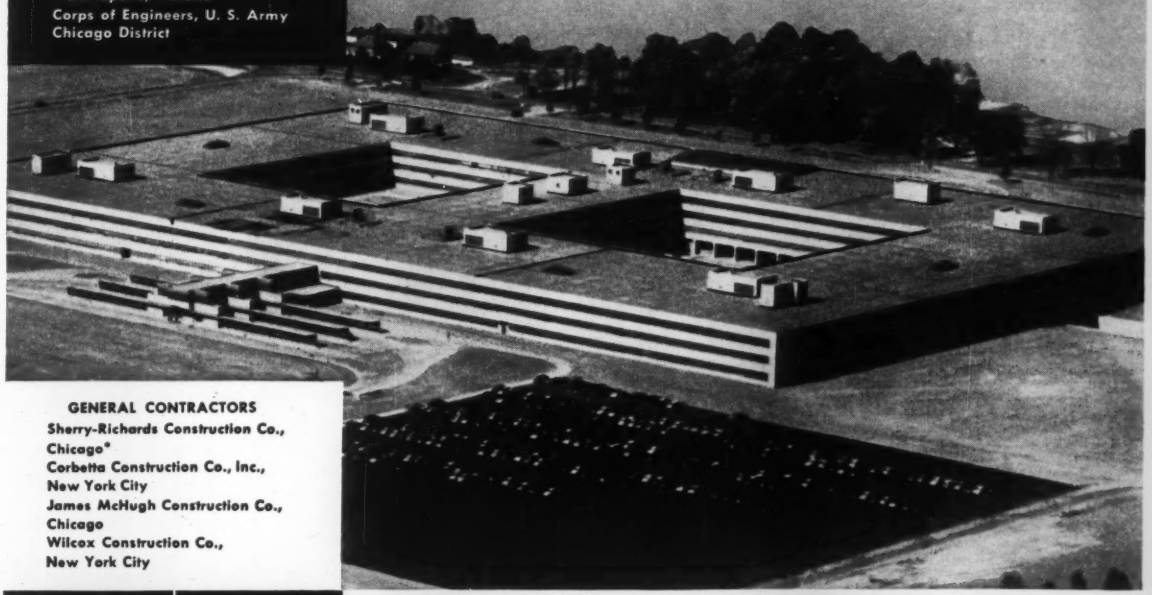
Reinforced concrete was found to be more economical than other structural materials . . . erection progress more rapid . . . maintenance costs were estimated to be less . . . and it proved to be the most adaptable medium for such a low, spread-out structure.

Reinforced concrete is the ideal material for structures of practically all types and shapes. It provides rugged strength that is highly resistant to wind, shock, and quakes, and is firesafe without extra treatment. Furthermore, it permits great flexibility of design, and materials and labor are readily available from local areas. On your next job, it may well pay you to *design for reinforced concrete.*

"REINFORCED CONCRETE is more economical... faster to erect... less costly to maintain"

ARMY FINANCE CENTER

Army Finance Center, U. S. Army
Indianapolis, Indiana
Corps of Engineers, U. S. Army
Chicago District



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Corbetta Construction Co., Inc., New York City
James McHugh Construction Co., Chicago
Wilcox Construction Co., New York City

*Construction and supervision by Sherry-Richards, sponsor of joint venture.

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CONCRETE REINFORCING STEEL INSTITUTE

The **Nebraska Section** reports that 1955 was one of its most successful years, with attendance at the monthly meetings averaging 32 (very good considering the distances to be traveled) and a Branch (the Section's first) set up at McCook. The Section pays tribute to the late R. O. Green as "the spark in the institution of the new Branch." New Section officers are Wendell E. Johnson, president; Paul C. Benedict, senior vice-president; K. B. Lucas, junior vice-president; and Aaron H. Bauman, secretary-treasurer.

The **New Mexico Section** is making a "strenuous effort" to organize a Junior Forum. Details will be worked out at the Section's spring meeting—a joint venture with the **El Paso Branch** of the **Texas Section** at El Paso, April 13 and 14.

Edward C. Keane, who is with Fay, Spofford & Thorndike, Boston, has been elected president of the **Northeastern Section.**

At a recent **Northwestern Section** meeting devoted to precast and prestressed concrete, Robert Randall, district structural engineer for the Portland Cement Association, and Norbert Soukup, secretary-treasurer of the Prestressed Concrete Co., had the floor. A supplementary film showing developments in prestressed and precast concrete in Europe and the British Isles revealed the major role of these methods in European construction. In this country, Mr. Randall said, twenty-six state highway departments are now using prestressed and precast concrete units.

A recent **Oregon Section** resolution honored fellow member John H. Collins and his wife, Helen Collins, for their able service as editors of its monthly publication, "The Oregon Civil Engineer," for the past two years. Featured speaker at the Section's January meeting was Dr. Morgan S. Odell, president of Lewis and Clark College, whose interesting talk dealt with the original Lewis and Clark Expedition. New officers, installed during the program, are Robert M. Bonney, president; David J. Lewis and Charles F. Craig, vice-presidents; James L. Apperson, secretary; and John T. Merrifield, treasurer.

In the **Panama Section** the 1956 slate is Hugh M. Arnold, president; Celso A. Carbonell and Robert J. Risberg, vice-presidents; and David L. Hartwell, secretary-treasurer.

The application of aerial photography in soil mapping was explained in the principal talk at the **Providence Section's** December meeting. Kendall Multrop, assistant professor of civil engineering at the University of Rhode Island, was the speaker. At the Section's January meeting, a joint session with the Brown University Student Chapter, Capt. J. J. Alvers, of the Navy Civil Engineer Corps, showed films on the recent placing of the Texas Towers off Cape Cod. Captain Alvers was Navy officer in charge of the work.

Cornelius Elmendorf, new life member of the **Rochester Section,** received his certificate at the Section's January meeting. What's expected of a Society Director was the subject of an informal talk given by recently elected ASCE Director Carey H. Brown. At the close of the meeting E. K. Smith took over as new Section president. Other 1956 officers are W. E. Dinn and J. N. Covey, vice-presidents; R. J. Van Epps, secretary; and R. J. McVeigh, treasurer.

San Diego County's critical water situation was the subject of a panel discussion making up the program for the **San Diego Section's** January meeting. Suggested sources of the new supply that will be imperative in five to ten years include the Feather River Project, reclamation of sewage and surplus drainage water, conservation, and distillation. Taking part were Paul Beerman, director of the city's Water Department; R. S. Holmgren, general manager and chief engineer of the San Diego County Water District; M. J. Shelton, general manager and chief engineer of La Mesa Lemon Grove and Spring Valley Irrigation District; and W. G. Sloan, consulting engineer for the San Diego County Water Authority.

January 11 was "Life Member Night" in the **Seattle Section,** with certificates presented to Richard Ellis, N. Henry Gellert, Adrian J. Gilardi, Earl L. Hageman, Ernest B. Nelson, Carl D. Pollock, and E. L. Strandberg. The tremendous problem involved in keeping Lake Washington water free from pollution was discussed by E. F. Eldridge, director of the Pollution Control Commission, and W. Thomas Edmondson, assistant professor of zoology at the University of Washington. The talks revealed that already algae conditions in the lake warn of excessive chemical nutrient load, and that contamination has made it necessary to close some of the recreational areas.

Scheduled ASCE Conventions

KNOXVILLE CONVENTION
Knoxville, Tenn.
University of Tennessee
June 4–8, 1956

PITTSBURGH CONVENTION
Pittsburgh, Pa.
William Penn Hotel
October 15–19, 1956

JACKSON CONVENTION
Jackson, Miss.
Hotel Heidelberg
February 18–22, 1957

Walter Huber, Past-President of ASCE and long-time member of the San Francisco Section, cuts sparkler-bedecked cake at party marking the Section's fiftieth anniversary.

Appearing on the technical program at the **South Carolina Section's** annual winter meeting—a joint session with the South Carolina Society of Engineers in Columbia on January 13—were J. W. Wedding, director of the I.B.M.'s new Production Testing Laboratory at Poughkeepsie, who spoke on the development of electronic computers; Harvey E. Atkinson, materials engineer for E. I. du Pont de Nemours & Co., whose paper was on plastics as engineering materials; and Owen H. Perry, president and manager of Marine Minerals, Inc., Bath, S.C., who read a paper on mining and production of titanium in Horse Creek Valley, S.C. James A. Hicks, of Charleston, was elected president for 1956. The other officers carry over for another year.

Featured speaker at the **Tri-City Section's** January meeting was Connie Bodine, city manager of Rock Island, Ill., whose talk dealt with the problems involved in changing to the city manager form of government. Mr. Bodine sees the problem as resolving itself into three basic divisions—political, management, and lines of responsibility. C. P. Conrad, long-time Section member and new life member was honored in absentia since he was too ill to attend the meeting. (Mr. Conrad died on January 24, a few days after the meeting, at which he was hailed for his contributions to Midwest industry). The Section's new officers are Robert F. Erickson, president; C. H. Walker, vice-president; and James R. Swanson, secretary-treasurer.

When steel frames can be simplified . . .

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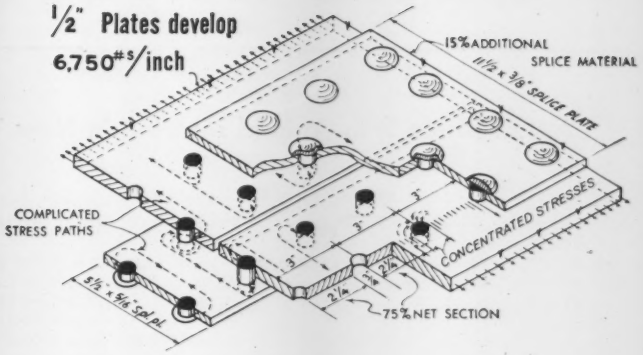
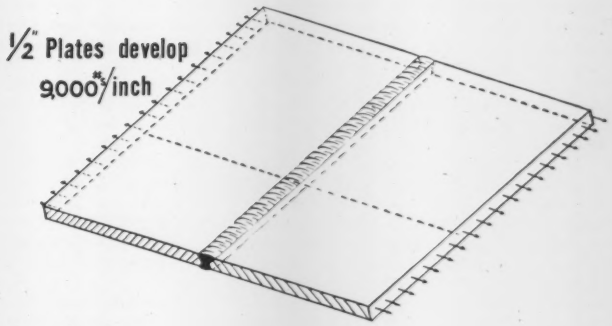
Yet erected for less cost . . .

WHY shouldn't you design for welding



TYPICAL RIVETED JOINT—*Requires punching, splice plates and rivets*



TYPICAL WELDED JOINT—*Provides continuity of original section . . . eliminates stress concentrations*

WHY punch holes in structural steel . . . only to fill them with rivets.

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NEWS BRIEFS . . .

A.G.C. Holds 37th Annual Meeting in New York

Leaders of America's construction industry attending the 37th annual convention of the Associated General Contractors of America, held at the Waldorf Astoria in New York the week of February 13, discussed their relations with government contracting agencies and considered with pleasure the anticipated $60 billion construction year forecast for 1956. H. E. Foreman, managing director of the A.G.C., pointed out that 1955 was the tenth consecutive record-breaking year for the construction industry. Noting that $1 of every $7 spent for goods and services in the United States goes for construction, he declared that the industry accounts for more than 15 percent of the total employment directly and indirectly. The $60 billion construction year forecast includes $44.5 billion of new construction, and $15.5 billion of maintenance and repair construction.

A survey of the A.G.C.'s more than 6,500 members indicated that building, highway, and heavy construction are all expected to increase in volume next year. Over 80 percent of the membership anticipated an increase in material and equipment prices; 20 percent thought there would be no change; no one expected a decrease. Tabulations of contractors' bid prices showed that 29 percent expected bid prices to go up, 47 percent expected no change, and 24 percent believed there would be a decrease in bid prices. With regard to the degree of competition among contractors, 79 percent felt that there would be no change in the present situation. The survey revealed widespread concern among contractors over the availability of materials, with shortages of steel, cement, and glass mentioned most frequently.

In an address before the general session of the convention Walker L. Cisler, president of the Detroit Edison Co., stated that the future potential of atomic fuels is great. At the present time we can generate $4^1/_2$ kwhr from $3^1/_4$ lb of coal. The potential energy content of $3^1/_4$ lb of uranium is enough to generate 12,000,000 kwhr. In other words, a pound of uranium is equivalent to 1,300 tons of coal. Extremely important to our future is the fact that the known reserves of atomic fuels, uranium and thorium, are twenty-three times greater than all the fossil fuels.

Speaking for the recently merged AFL-CIO Maurice A. Hutcheson, general president of the United Brotherhood of Carpenters and Joiners of America, said that, "The American labor movement in 1956 will not allow itself to be jockeyed into hanging on to the coattails of any single political party. The more than 15,000,000 individual AFL-CIO members will, per custom, exercise their own judgment, supporting old friends and rejecting their foes."

Representatives of the Bureau of Yards and Docks, the Air Force, and the Corps of Engineers also addressed the assembled contractors. Rear Admiral Robert H. Meade, chief of the Bureau of Yards and Docks, stated that as a contracting agency for the United States Government, the Bureau has long felt that, wherever practicable (which is, in fact, nearly every case) construction should be procured through the use of open, competitively bid lump-sum contracts. He noted, however, that "The plan of negotiating on a competitive basis with selected bidders after a process of elimination among qualified contractors is a method of considerable merit."

Speaking of the changes wrought in airfield design by our constantly progressing aeronautic technology, Maj. Gen. Lee B. Washbourne, assistant chief of staff, for installations, Department of the Air Force, stated that, with natural exceptions, ". . . it is the Air Force's conclusion that concrete can take it and black-top cannot. The present policy is that the primary use areas involving combat aircraft of the Air Force are to be built of portland cement concrete." He further noted that it has been demonstrated "that the difference in cost between concrete and black-top has been a minor consideration."

Maj. Gen. S. D. Sturgis, Jr., Chief of Engineers, U. S. Army, stated that "The military construction program launched in 1950 is still more than a billion dollars away from completion and there is a constant net increase in our requirements each year." Speaking of the organization of the defense establishment, General Sturgis remarked on the need for more men with construction experience in top positions in it, and asked the A.G.C. to raise volunteers as "an act of patriotism in time of need."

The highway program cannot be overlooked in any survey of the construction industry. C. D. Curtiss, commissioner of the Bureau of Public Roads, stated that "land use and business and industrial growth tell an almost unbelievable story in progress and development in the wake of controlled access roads. Citing Route 128 in the Boston Metropolitan area, he stated that it "has served as a magnet attracting an amazingly diversified group of

Southern Pacific Opens Automatic Switching Yard at Houston

Southern Pacific's new $7,000,000 radar gravity switching yard in Houston, Tex., which was dedicated on February 15, is the only fully automatic classification yard in the Southwest. The new facility does away with traditional arm- and lantern-waving methods of railroad-yard operation, substituting for them push-button throwing of the switches and communication between engineers and yardmasters via radio telephone and "walky-talky." New electronic equipment saves more than two hours of switching time on each train passing through the Houston yard and more than doubles the capacity of the yard by slowing fast-moving cars to proper momentum to carry them down the tracks to the lower end where "skates" stop them at desired locations.

industries. . . . Land that sold for $50 or $100 an acre before Route 128 was built, now commands $5,000 to $10,000 an acre." In connection with the New York Thruway, not yet completed and only recently opened to traffic, Mr. Curtiss said, "It has been conservatively estimated that already more than $150 million worth of new industrial plants have been erected adjacent to it."

In further discussion of the effect of the highway program on our economy, Rex M. Whitton, chief engineer of the Missouri State Highway Department and president of the AASHO, noted that we have added only about 1 percent to the 3,300,000 miles of roads in existence at the outbreak of World War II. "The result has been such that our economic loss last year due to inadequate highways was at least $4 billion, with no money value placed on the huge loss in life and personal injuries." Mr. Whitton went on to say that the highway program "cannot be a year-to-year or hand-to-mouth undertaking. Only a stable and committed program for a completed job will induce and enable contractors and equipment manufacturers, materials producers, and state highway departments to plan adequately and to execute the program properly."

The association's newly elected officers, installed at the end of the meeting, are Frank N. Rooney, of Miami Beach, president, and Lester Rogers, M. ASCE, Chicago, vice-president.

New Cement Facility To Be Ready Soon

The Calaveras Cement Co. has advanced by several months the completion date of its $4,000,000 plant-expansion program, originally scheduled for the end of 1956, according to an announcement from President W. W. Mein, Jr. Major item in the expansion program is a 360-ft rotary kiln, which will raise the production capacity of the Calaveras plant at San Andreas by 30 percent to more than 4,500,000 barrels of cement a year. The kiln is now in the final stages of fabrication in the San Francisco shipyards of the Bethlehem Pacific Coast Steel Corp., which holds the job under subcontract from the Allis-Chalmers Manufacturing Co., of Milwaukee. It is the company's fifth such unit.

Lake Erie Water Studied As Possible Supply Source

The feasibility of using Lake Erie water as a source of supply for a six-county area in northeastern Ohio is being studied by the Stanley Engineering Co., of Muscatine, Iowa, and Chicago, Ill., under the terms of a recent contract signed with the Lake Erie Watershed Conservation Foundation, of Cleveland. The study will include an estimate of population and industrial growth as well as of the agricultural requirements for water in the six counties. It will also consider alternative plans for providing the area with water.

If the Lake Erie plan proves feasible, a 4,000-sq mile area will be flooded as a supply reservoir. The study will also pave the way for creation of a great regional water district, which would be self supporting with revenues paying the bonds necessary for the recommended installations. It will take in Cuyahoga, Geauga, Ashtabula, Portage, Summit, and Lake counties, where supplies have been dwindling in recent years and water quality has been poor.

The studies will be handled by Frank W. Edwards, M. ASCE, manager of the Chicago office of the Stanley Engineering Co., and A. H. Dunton, head of the Report and Research Section, together with H. S. Smith and C. M. Stanley, Members ASCE.

New G.M. Auditorium Features Stiffened Thin-Sheet Roof

The focal point of the new General Motors Technical Center in Detroit will be a circular styling auditorium with an unusual welded spherical dome. Ingenious dome design, eliminating trusses and utilizing only thin sheet steel stiffened by a network of steel angles, will provide a clear exhibit area with a diameter of 186 ft to the inside of the peripheral columns. The auditorium will be dedicated in May.

Around the circumference of the building there are 40 rectangular-shaped columns, each 8 by 12 in. and $9\frac{1}{2}$ ft high. These columns support a box girder, 12 in. wide and 14 in. high, built in circular form. The spherical dome rests on this girder, which has a horizontal rain gutter extending 2 ft outside it. The main dome, with a spherical radius of 107 ft $4\frac{7}{16}$ in., is made up of shaped shell plates of the "orange-peel" type welded in four circumferential rows. The lower row (next to the box girder) has 80 plates, the second row 60, the third row 48, and the top row 24.

Plate thickness is $\frac{3}{8}$ in. If the plates were plain, the allowable external load would be 22 psf, of which the plate itself weighs 16 lb. However, stiffening angles on the underside of the plates raise the allowable load to 55 psf with a factor of safety of 3.

There are both radial and ring stiffeners. The radial stiffeners are $6 \times 3\frac{1}{2} \times \frac{5}{16}$, or $5 \times 3 \times \frac{5}{16}$ angles, located 4 in. from the edge of each plate. The ring stiffeners are made of $6 \times 4 \times \frac{5}{8}$ angles for the outermost row, and $6 \times 4 \times \frac{1}{2}$ for the others. The distance between the adjacent rings of stiffeners is about 27 ft measured along the arc.

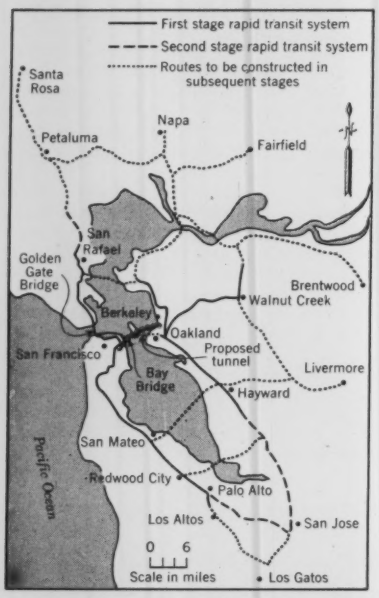
The total weight of the shell plates and stiffeners is 640,000 lb. If the shell had not been stiffened, its thickness to avoid buckling would have had to be 0.59 in. and its weight 900,000 lb, or a saving of 260,000 lb.

Credit for the unusual design goes to Chicago Bridge & Iron Co., working with the architects, Saarinen & Associates. The engineers were Smith, Hinchman & Grylls, and the general contractor was Bryant and Detwiler. Chicago Bridge & Iron handled the all-welded structural steel work.

New-type stiffened thin-sheet roof for General Motors styling auditorium, to be dedicated in May, provides large unobstructed area and permits important savings in steel. Roof design permitted construction at a thickness and weight substantially below those of similar structures.

Rapid Transit System Recommended for San Francisco Area

A bold new look is in prospect for the San Francisco Bay area if recommendations for a coordinated rapid transit plan—presented early in January to the San Francisco Bay Area Rapid Transit Commission—are carried out. The suggested plan, which is aimed at reducing the critical traffic congestion in the Bay area and increasing travel comfort for the population of more than 3,000,000, is the outgrowth of a two-year survey made at the request of the Commission. The survey was conducted by the New York consulting firm of Parsons, Brinckerhoff, Hall and Macdonald. Consultants to the firm included Gibbs and Hill, Inc., who made a study of suspended train systems; James H. Griffin, who conducted traffic and transportation studies; and the firm of Adams Howard & Greeley, of Boston, advisers in the field of regional planning.



Proposed first-stage rapid-transit system for San Francisco Bay area, indicated by solid line, would cover 123 miles. Future extensions are shown in dotted lines. Recommended initial construction calls for a trans-Bay tube, and subways in downtown San Francisco and Oakland. A less expensive and less desirable alternate is to use the Bay Bridge with elevated structures in the two cities.

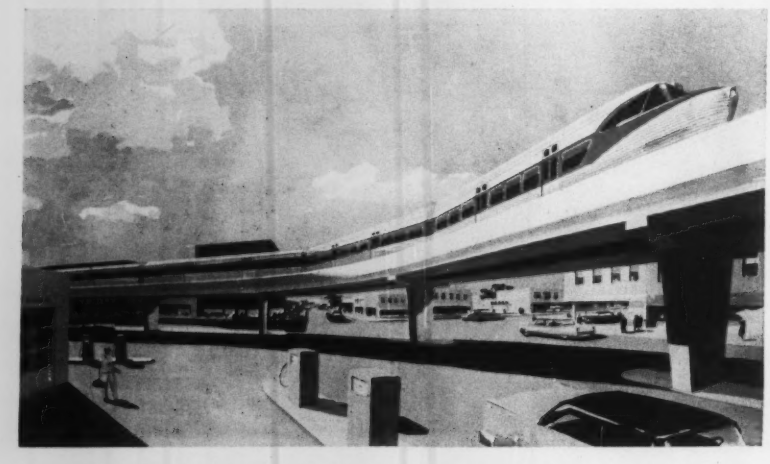
As a result of its basic studies the firm is convinced that the prosperity of the entire Bay area depends upon the preservation and enhancement of its urban centers and subcenters rather than decentralization, and that to sustain these centers "means the reinvigoration of interurban transit." The downtown parking problem lets out the use of cars and buses.

Working on the premise that the utilization of high-speed, grade-separated, interurban rapid transit as a supplement to the regional highway network is the answer to the ever-worsening traffic problem of the Bay area, the firm prepared two alternate plans for first-stage construction—an Optimum Plan and a Minimum Plan. Both are technically feasible, the chief difference between them being the specific physical facilities proposed for the trans-bay crossing and the two terminals the crossing would connect. The Optimum Plan calls for construction of a trans-Bay tube and underground stations at Kearny Street and along Market Street in San Francisco, and along Broadway in Oakland. The Minimum Plan is based upon continued utilization of the San Francisco–Oakland Bay Bridge, the Key System Terminal, and elevated stations on Mission Street in San Francisco, and in Oakland.

Though the Optimum Plan for initial construction would cost $130,500,000 more than the Minimum Plan, the firm recommends it for a number of reasons. Most important is the fact that rapid-transit travel time between San Francisco and Oakland would only be 11 minutes, just half the best speed attainable under the Minimum Plan with its longer route, tortuous bridge approaches, and speed restrictions on the bridge. In addition, stations and lines in the crowded confines of downtown San Francisco and Oakland would be underground, and passenger delivery would be made to the points most convenient for most travelers. The Optimum Plan would also add two automobile lanes to the capacity of the Bay Bridge by utilizing the space now occupied by the Key System tracks. According to the firm's traffic studies, modern rapid transit in the proposed trans-Bay tube, in conjunction with the expanded capacity of the Bay bridge, would be adequate to ensure free flow of weekday trans-Bay traffic, even if no additional automobile crossing is constructed for fifteen years. (A proposed second motor vehicle crossing between San Francisco and the East Bay at Army Street will soon be voted upon by the state legislature, February issue, page 76).

In a study of facilities, it was found that the choice narrowed down to two basic types of trains—a suspended system in which cars would be suspended from four-wheel trucks running on a narrow-gauge track contained within a supporting structure above it, and supported trains, in which the cars are supported on four-wheel trucks operating over tracks below. The firm recommends the supported train. The outstanding advantage of the supported system is that where appropriate rights-of-way are available, trains can run on the ground, eliminating the cost of elevated structure. Approximately 30 miles of the total 123 miles of first-stage construction routes are suitable for surface operation.

First-stage construction costs are estimated at $586,000,000 for the Minimum Plan and $716,500,000 for the Optimum Plan. Future extensions would bring the total cost of a comprehensive regional rapid-transit plan to $1,545,000,000. Stanford Research Institute is working out a financing plan for the Transit Commission. It is expected that construction



Supported train of type recommended for Bay area is shown in artist's rendering. Noise-reducing features have been incorporated into the design of a Budd prototype steel-wheel vehicle. Welded steel rails on resilient pads and concrete structure with parapets overlapping vehicle skirting will also aid in noise reduction.

of a first-stage rapid-transit system would require an annual public commitment of from $33,000,000 to $38,000,000 (for up to 30 years, depending on terms of financing), in addition to what may be recovered from fares. Stating its belief that without a rapid-transit system the region will ultimately have to pay many times the cost of what such a system would be, the engineers' report concludes, "We do not doubt that the Bay area citizens can afford rapid transit; we question seriously whether they can afford *not* to have it."

Large Aluminum Plant to Be Built in Ohio Valley

Plans to enter the aluminum industry with an initial investment of $120,000,000 and the world's first fully integrated aluminum plant have been announced by the Olin Mathieson Chemical Corp., through its president, Thomas S. Nichols. The new operation will mark the first time in the history of the industry when coal mined directly on the site is used to provide the tremendous power supply required for the reduction of alumina to pig aluminum. Investment in the new operation includes approximately $90,000,000 for the aluminum plant and $30,000,000 for the required power facilities. Capacity of the alumina plant will be 230,000 tons per year and of the aluminum plant 60,000 tons.

The alumina plant, reduction plant, and rolling mill will be on the Ohio River near Clarington, Ohio. The power plant, to be engineered and built by the American Gas and Electric Co., will be slightly upstream on the West Virginia side at Cresap Bottom and will be connected to the aluminum facilities by a high-tension transmission line. It will be built on a major coal mine to be operated by the Pittsburgh Consolidation Coal Co.

The power plant, which will be called the Kammer Plant, will consist of two units of 225,000 kw each. Both units will be operated by the Ohio Power Company, a subsidiary of American Gas and Electric, and integrated into the latter's system. The plant will be designed for a potential development up to 1,350,000 kw capacity.

AIEE Told Shortage of Engineers Will Continue

Despite increased enrollment in engineering courses, there will be a scarcity of engineers for years to come because of automation and scientific industry, J. D. Ryder, dean of engineering at Michigan State University, told the winter general meeting of the American Institute of Electrical Engineers, which was held at the Statler Hotel in New York, January 30-February 2. Addressing a symposium on education on "The Personnel Problems of the Public Utilities in the Colleges," Professor Ryder noted that, while the number of engineering college graduates can be expected to increase to twice the present level by 1970, "the needs of an automated and scientific industry will increase even faster. In fact, to reach a level of 800,000 engineers which may be needed by 1970 would require an annual bachelor's degree output varying from 32,000 now to 40,000 in that later year. We are yet some years away from even meeting the current demands, and are therefore making no progress in an attack on the backlog of engineers needed . . . Much more engineering goes into a turbine than went into a Corliss engine, more engineering in a TV set than in the crystal radio set of 1920, and this is true throughout our complex modern life."

The shortage of engineers has created a buyer's market, with the student engineers as the buyers and industry as sellers, he said in advising the utilities, in particular, to change their recruiting methods in colleges. Professor Ryder recommended that utilities, in order to get the better grade of graduate, take a look at their pay scale and make their work more interesting and creative. "It is apparent," he asserted, "that unless an industry can offer creative opportunity it must be satisfied with only repetitive mediocrity."

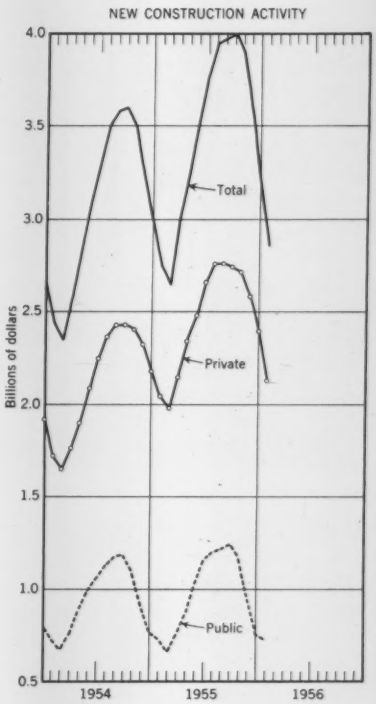
At the opening session on January 30 Mervin S. Coover, head of the electrical engineering department at Iowa State College, was nominated for the 1956–1957 presidency of the AIEE. Honorary membership was conferred on James F. Fairman, vice-president of the Consolidated Edison Co., by Morris D. Hooven, current president of the AIEE.

Construction Activity at Record January Rate

Though the value of new construction activity declined seasonally in January 1956 to $2.85 billion, it exceeded the previous January record set in 1955 by 1 percent, according to preliminary estimates prepared jointly by the U. S. Departments of Commerce and Labor. On a seasonally adjusted basis, outlays for new construction last month were at an annual rate of $41.5 billion, compared with actual expenditures of $42.3 billion in 1955.

Private construction declined 12 percent in January, reflecting a slightly more than seasonal decrease in residential building. Industrial building continued the upward swing, which began in the fourth quarter of 1954, and established a new monthly record amounting to $228 million. Commercial building (offices and stores, etc.) declined 7 percent, but reached a new January high of $249 million, nearly one-third above expenditures a year ago.

Public construction expenditures, in total, showed a normal overall seasonal decline of 6 percent. Nevertheless, new January highs were recorded, in outlays for highways, public schools, and sewer and water projects. Compared with January a year ago, substantial increases were noted for military facilities and public service enterprises, reflecting a continuation of the higher levels prevailing during the latter half of 1955.



Construction activity declines seasonally in January to $2.85 billion, but exceeds January record set in 1955 by 1 per cent.

Caterpillar Tractor to Have Glasgow Plant

A new facility for manufacturing Caterpillar Tractors (crawler type) in the United Kingdom is scheduled for early construction in Glasgow, Scotland, according to executives of the Caterpillar Tractor Co., Ltd., of Great Britain, a subsidiary of Caterpillar Tractor. Ground will soon be broken for a 500,000-sq ft plant, which will turn out Cat D8 and D4 Tractors, exact counterparts of American models. It is expected that the plant will commence operation by 1958, and that it will employ about 1,500 at the outset.

Los Angeles to Enlarge Hyperion Treatment Plant

Aerial view of Los Angeles Hyperion Treatment Plant shows projected modifications and improvements, totaling $40,000,000 and being designed by Hyperion Engineers for the city's Board of Public Works. Plans have been completed for new sludge-pumping plant, seven-mile sludge outfall, and part of an eight-mile main sewer outfall. Hyperion Engineers, joint venture firm of Los Angeles engineers organized to draw up plans, consists of (left to right, small view) Ray Spencer and D. Lee Narver, Members ASCE, and Irvan Mendenhall, A.M. ASCE.

Members to Aid Army in Columbia River Review

A board of consultants for the Columbia River Review study being conducted by the North Pacific Division of the Corps of Engineers has been selected from prominent engineering firms and power companies, according to an announcement from Brig. Gen. L. H. Foote, M. ASCE, North Pacific Division Engineer. It consists of Calvin V. Davis, M. ASCE, of the Harza Engineering Co., Chicago; Walter H. Huber, Past-President ASCE, consulting engineer of San Francisco; Hibbert M. Hill, M. ASCE, chief engineer, Northern States Power Co., Minneapolis; and Samuel B. Morris, Director ASCE, who recently retired as general manager and chief engineer of the Los Angeles Department of Water and Power.

An important aspect of the review studies, which were authorized by Congress last fall, is the development of Columbia River power resources. The studies will place special emphasis on hydroelectric resources, as they are integrated more extensively with power from steam or nuclear generation in a period fifteen to thirty years in the future.

U.S. and Mexico Plan Joint Diversion Dam

Plans for early construction of Anzalduas Diversion Dam on the Rio Grande have been announced in a recent joint statement of United States Commissioner L. H. Hewitt and Mexican Commissioner David Herrera Jordan, of the International Boundary and Water Commission. Located about eight miles south of McAllen, Tex., and four miles upstream from Reynosa, Tamaulipas, the dam will be built jointly by the United States and Mexico through the Commission. The cost of about $5,000,000 (United States currency) will be shared equally.

Primarily a flood control structure, the project will essentially complete the Lower Rio Grande Flood Control Project undertaken by the United States and Mexico in 1933. It will be operated to divert flood waters into the Gulf, limiting to 110,000 cfs maximum expected flows passing the dam. Mexico will make additional use of the project for irrigation.

The plans, prepared for the Commission by the Ministry of Hydraulic Resources of Mexico, call for a gated structure, with concrete foundation, abutments and piers, 524 ft in length between abutments. There will be six electrically controlled gates—each a 14-ft-dia cylinder, 75 ft in length, with a projecting lip at the bottom making its overall height 21 ft. In operation, the gates roll up an inclined track, providing either full or partial opening as desired.

Passamaquoddy Survey Bill Signed by President

President Eisenhower has signed a bill authorizing a $30,000,000 survey to determine the cost and economic feasibility of the Passamaquoddy tidal power project. The much-discussed Passamaquoddy Project, begun and abandoned in the thirties, was a wholly American undertaking, involving Cobscook Bay in Maine and requiring an expensive pump-storage feature to provide power during slack tides. If carried out, the present proposal would be an international undertaking involving both Cobscook and Passamaquoddy bays. It would be a two-pool system and would not require pumping.

The survey will be made by the International Joint Commission on United States-Canadian Boundary Waters.

1955 Was Second Best Year in Homebuilding

Almost 1,330,000 non-farm homes were started in 1955, the Department of Labor's Bureau of Labor Statistics reports. This total—second only to the record 1,396,000 units started in 1950—is 9 percent above the 1954 total. Starts in December 1955 declined seasonally to 75,000 units—17 percent below November. The December total of 72,200 units represented a seasonally adjusted annual rate of 1,187,000 units. Though the seasonally adjusted rate has declined each month since September 1955, it averaged over 1.2 million units in the last three months of 1955—the highest fourth-quarter rate in any year except 1954 when builders were taking advantage of the substantially increased supply of mortgage funds available on favorable terms.

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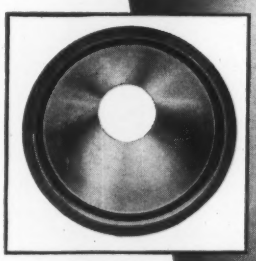

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King and Slocum Receive Moles Awards

Talking things over just before the 1956 Moles Award Dinner at the Waldorf-Astoria Hotel in New York are, left to right, A Holmes Crimmins, president of The Moles; Harvey Slocum, non-member Award winner; Howard Langdon King, member winner; Benjamin F. Fairless, president of the American Iron and Steel Institute and principal speaker; and Eugene F. Moran, Jr., chairman of the Award Committee.

The highest honors attainable in the field of heavy construction were accorded two men—one from New York and one from California—at the annual Awards Dinner of The Moles, New York society of heavy construction men, held at the Waldorf-Astoria Hotel in New York, February 2. Howard Langdon King, M. ASCE, of Port Washington, N.Y., and Harvey Slocum of Alhambra, Calif., became the sixteenth pair of recipients of the Moles Awards, given annually to one member and one non-member, for outstanding achievement and contributions to the art of heavy construction.

Benjamin F. Fairless, M. ASCE, president of the American Iron and Steel Institute, made the principal address at the dinner. Speaking on "Faith, Bulldozers, and Progress," he paid tribute to members of The Moles as men who, finding the right combination of faith and bulldozers, do literally "move mountains," and thereby contribute materially to the nation's and the world's aspirations for constantly higher standards of living.

The non-member award presentation to Harvey Slocum, almost invariably introduced as "the best dam man in the world," was made by Charles D. Riddle, of the Walsh Construction Co. Mr. Slocum has been responsible for the pouring of between 19 and 20,000,000 cu yd of concrete, in the building of many of the most famous dams in this country. He was in this country on a short leave from his job of supervising construction of Bhakra Dam in India, largest dam in the Far East. The great dams built under his general direction include Hetch Hetchy, Sierra Madre, Grand Coulee, Friant Dam, and Davis Dam.

The member-award presentation to Mr. King, vice-president and chief engineer of the Mason and Hanger Co., was made by Miles Killmer of that company. Mr. King, who was born in New York City, and holds degrees from City College, Columbia University and Massachusetts Institute of Technology, has distinguished himself particularly in compressed-air subaqueous tunnel work in his long career. He has played an important part in many of the best known underwater and underground routes, such as all three tubes of the Lincoln Tunnel, the Brooklyn-Battery Tunnel, and the Holland Tunnel. His citation referred to him as "builder, scholar and administrator." Some 1,100 leading construction men from all over the country attended the Awards Dinner.

Engineering Teachers Urgently Needed

A recent letter from the New York City Board of Education calls attention "to the urgent need for engineers in the field of high school teaching." If engineers and technicians are to be trained, it comments, "we must have the necessary teaching personnel." Graduation from a four-year engineering school is required, and minimum engineering experience is three years. Starting salary for a regular teacher, who has had five years of experience, is $4,888, and $5,888 if he has a master's degree. Raises bring these salaries up to $7,200 and $7,600.

Further information is available from Nathan Clark, Supervisor, Related Technical Subjects, Board of Education, 110 Livingston St., Brooklyn 1, N.Y.

Contractors Sought For Alaska Projects

Additional military construction for Alaska, estimated at $33,500,000, is scheduled for advertisement to contractors during the final half of the fiscal year ending June 30, according to the Alaska District Office of the Corps of Engineers. The work involves 51 separate projects scattered throughout the territory, with larger jobs concentrated in the Anchorage and Fairbanks areas. The projects are listed in a semiannual brochure of advance information to bidders, which is available from the Alaska District Office at Anchorage.

Peru Completes Large Irrigation Project

The Chotana-Chancay irrigation project in northern Peru is being completed by the Morrison-Knudsen Construction Co. under a $1,800,000 contract with the Peruvian government. Designed to provide an adequate all-year water supply for some 148,260 acres in the rice-growing Department of Lambayeque, the project featured driving a 15,310-ft tunnel under the Continental Divide, to divert Chotano River waters, draining into the Amazon Basin, into the Chancay River. It also includes a canal and three shorter tunnels totaling 1,640 ft.

Morrison-Knudson took over the completion of the project in September 1954 after government contractors and a European construction company had begun it.

Prize Contest for Welding Ideas Open

To accelerate progress in arc welding, the James F. Lincoln Arc Welding Foundation is sponsoring a new $20,000 program of awards for ideas or suggestions. Residents of the United States or its possessions are invited to submit ideas on any aspect of the subject that can be used to advance welded design, welding engineering, or the general application of the arc-welding process. There are no restrictions on either the nature or the extent of the ideas submitted. The $20,000 will be distributed in twenty awards, with a top award of $5,000, others of $4,000, $3,000, $2,000, and $1,000, and additional smaller awards.

Ideas must be submitted by July 30, 1956. Complete information and rules are available from the James F. Lincoln Arc Welding Foundation, Cleveland 17, Ohio.

FAST, ECONOMICAL BRIDGE CONSTRUCTION

with ARMCO STEEL PIPE PILING

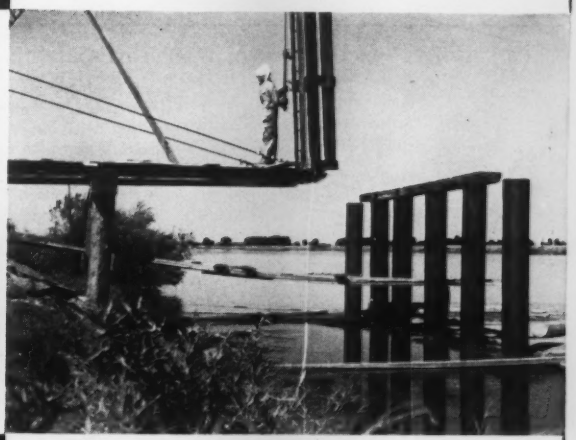
Exposed Pile Bent Construction

- *Saves Time*
- *Saves Formwork*
- *Saves Materials*

These three bridges illustrate some of the advantages of exposed pile bent construction with Armco Steel Pipe Piling. See how Armco Pipe Piling helped solve both engineering and construction problems.

Formwork is held to a minimum, time and materials saved. Here concrete is poured in Armco Pipe Piles for New Mexico's Alameda Bridge across the Rio Grande River.

Pile bent construction is easily adapted to large bridges or small ones like this structure in Eau Claire County, Wisconsin. Pipe Piling used here was 14-inch diameter, .188" wall thickness. The wide range of diameter-wall thickness combinations of Armco Piling makes it easy to specify exactly what you need.



With most jobs there is no need to divert the stream or dewater the site. Cast-in-place Armco Pipe Piles stay water-tight under the impact of driving. Water is no problem.

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for complete data, Armco Drainage & Metal Products, Inc., 3726 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. In Canada: write Guelph, Ontario. Export: The Armco International Corporation.

ARMCO

ARMCO PIPE PILING

Rhadames Bridge Opened to Traffic in Dominican Republic

New Rhadames steel suspension bridge, recently opened to traffic in Ciudad Trujillo, Dominican Republic, spans the Ozama River where Christopher Columbus moored his caravels in 1496. Constructed by the American Bridge Division of U.S. Steel at a cost of $5,000,000 project has a 48-ft roadway, 576-ft suspended center span, and five 102-ft deck-truss spans. It crosses the river 600 yd above an old pier-supported, wood-planked structure, which is now being demolished to make room for new docks. A key structure in the Dominican Republic's $270,000,000 long-range construction program, the project links Ciudad Trujillo with the Villa Duarte low-cost housing development and with new superhighways under construction.

N * G * Neare's COLUMN

R. ROBINSON ROWE, M. ASCE

'Same old plot! Tough for Cal and a snap for me!"

"You mean, Joe, finding the fourth pool in the ne-plus-ultra patio was a snap?"

"For me, yup," scoffed Joe, "For Cal, nope, like I said. Drafting is one of the two things I do well, and this was a set-up. First I drew 3 circles tangent to each other with diameters of 330, 385 and 440 for the original purple, pink and pearl pools. Then I made an overlay of concentric circles with diameters of 825, 830, etc. and finagled it until one circle just girdled the pools, punching the center thru so as to draw the same circle on the pool map. Finally with another overlay of smaller circles, I juggled a squeeze fit in the vacant area. It was the 230-footer, so that's how big for the Pinto Pool."

"And why would that be 'tough for Cal'?" persisted the Professor.

"Oh, he has a gnat's-eyebrow complex—wants to know things to the zillionth. He'd set up equations, which I tried but ran into a mess of square roots, so . . ."

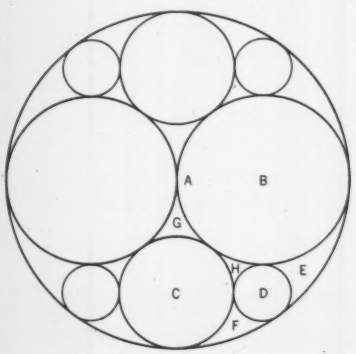


Fig. 1. Composite cookie-cutter engineered for automation.

"Now he admits it," sneered Cal Klater, "but in the Apolonnius problem with the circles cheek-to-cheek, that mess of radicals boils down to the simple form,

$$D = \frac{abc}{2\sqrt{abc(a+b+c)} - (ab+bc+ca)} \quad \ldots\ldots(1)$$

for the diameter of the patio in terms of the pool diameters. With $a, b, c = 330, 385, 440$, I found $D = 840$. Then solving for a,

$$a = \frac{bcD}{bD + cD - bc \pm 2\sqrt{bcD(D-b-c)}} \quad \ldots\ldots(2)$$

Using $b = 385$, $c = 440$ and $D = 840$, the double sign in (2) gives the two values $a = 330$, as given, and $a' = 231$ for the smaller pool on the other side of the two big ones. So I picked up a foot on Joe's 9H pencil; is that a gnat's eyebrow?"

"Off the record, I'd say you both had fun your own way. Cal's equations are in practical form, but I can't resist adding a more elegant form in terms of curvatures, which are reciprocals of the semi-diameters. If $e = 2/a$, $f = 2/b$, $g = 2/c$, and $h = 2/D$, then

$$e + f + g + h = 2\sqrt{ef + fg + ge} \quad \ldots\ldots(3)$$

"Any of these equations may help you in our new problem of perfecting automation in the cookie-cooking industry. Classical cookie cutting of round cookies from squared dough wasted or re-kneaded 21 percent of each batch. Square or hexagonal cookies were much less wasteful, but proved very unpopular. So automation developed the composite cookie cutter (Fig. 1) to cut rounded dough into round cookies of assorted sizes, reducing the waste to one-sixth. Carrying the idea further, suppose cookies were cut from each of the spaces like E, F, G and H, how much dough would be wasted?"

[*Cal Klaters were: Ross C. Durst, Richard Jenney, Ed C. Holt, Jr., Thomas Ogburn III, S. K. Rueball (Keith Jones), O'Kay (Otto Koch), and Emerson J. Boyd Jr.*]

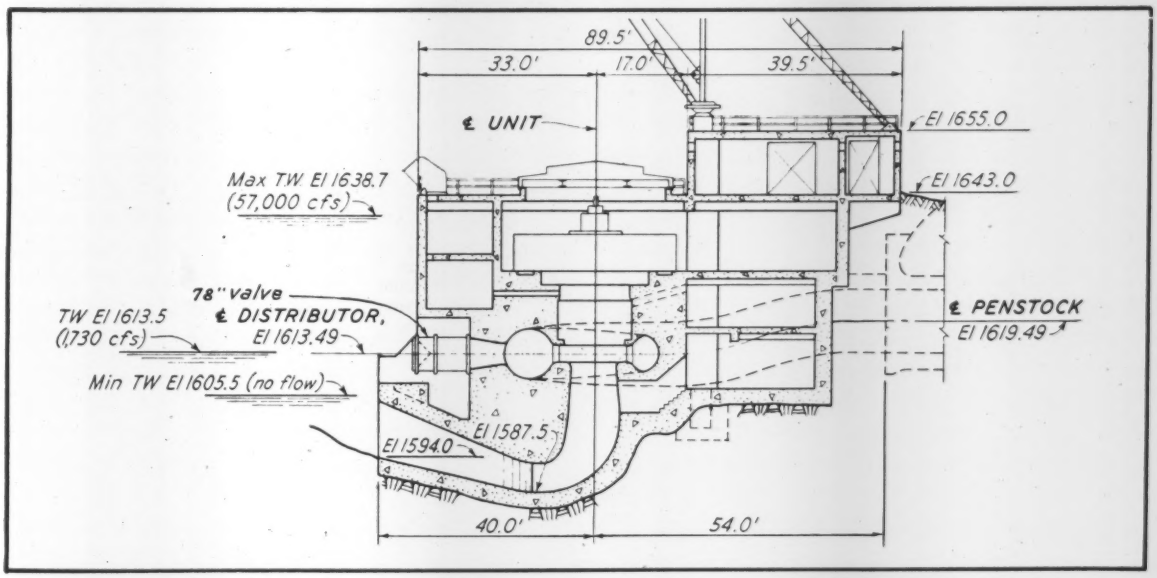
ASME Movie Available

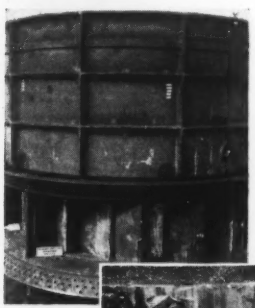
"To Enrich Mankind" is the title of a 25-minute color motion picture which has been prepared for the American Society of Mechanical Engineers. Released at the end of the society's Diamond Jubilee Year (1955), the film is designed "to explain to the public the significance of the role mechanical engineering plays in the development of our country." It is printed in Eastman Commercial Kadachrome on 16-mm reels.

Prints are available on loan, without charge, to schools, television stations, and non-profit organizations. Inquiries should be sent to Barbara A. Brown, Public Relations Dept., ASME, 29 West 39th St., New York 18, N.Y.

TVA Installs *Another* Leffel Turbine

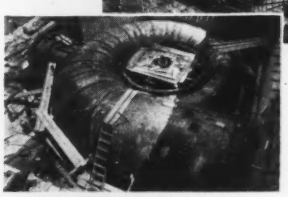
Nottely Dam Power Plant — a progress report as of the end of 1955





Completely assembled turbine except for riveted scroll case.

Powerhouse and draft tube forms in place.



Assembled scroll case in position from above.

In the new hydroelectric power plant on the Nottely River near Murphy, North Carolina, the TVA is now completing the installation of another efficient Leffel turbine.

Nottely Dam, of the rock and rolled earth fill type, was completed in 1942, without a power unit. Installation of the No. 1 power unit was authorized in 1951 and a Leffel turbine was selected to drive the generator.

The turbine is rated to develop 21,000 HP under a net head of 124 feet at 180 RPM. The specific speed of the turbine at rating is 63.2 RPM. The operating head varies from 76 feet to 166 feet.

Other Leffel turbines installed by the Tennessee Valley Authority are located at Chatuge Dam in North Carolina and Wilbur Dam in Tennessee.

The efficient design and rugged construction of the Nottely unit—backed by 94 years' of experience in the hydraulic turbine field—make it typical of the notable hydraulic turbines built by Leffel for hydroelectric power projects throughout the world.

Leffel engineers are trained in design, construction and adaptation of the turbine which will most efficiently and economically meet the needs of each power plant development, whether it is a completely new installation or part of an expansion of rehabilitation program.

Before you plan your next turbine installation, be sure you have the complete story on rugged, efficient Leffel turbines. Write, wire or phone . . . you'll get action fast.

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MORE EFFICIENT HYDRAULIC POWER FOR 94 YEARS

DECEASED

Norman William Anderson (A.M. '47), age 39, supervising civil engineer, specializing in hydraulic design, for the Los Angeles County Sanitation Districts, Los Angeles, Calif., died December 1. Mr. Anderson graduated from Oregon State College in 1940 and served during World War II with the Army Air Corps holding the rank of captain. He was active in the program of the Los Angeles Section's Sanitary Engineering Branch, which he served as secretary in 1954 and program chairman and vice-president in 1955.

William Nicholas Beach (A.M. '09), age 83, retired civil engineer of New York City, died recently. A graduate of Sheffield Scientific School of Yale University, class of 1892, he joined the Pennsylvania Cement Co. in 1900. He served as president and chief engineer from 1909 through 1923, when he went into private practice. He retired in 1945.

Billy Gene Bethea (J.M. '52), age 24, of Dallas Tex., was killed on January 20, when a bridge under construction across the Brazos River at Hempstead, Tex., collapsed. An army veteran and a graduate of Texas A & M College, Mr. Bethea had been employed for the past two years as a civil engineer for the Austin Bridge Co., of Dallas.

Joseph Z. Burgee (M. '48), age 58, since 1945 partner in the Chicago consulting firm of Holabird & Root, died suddenly on January 5 in New York City while on a business trip. For a number of years Mr. Burgee was connected with John W. Root and the firm of Holabird & Root, which he had served as construction engineer, resident engineer, and project manager on many works including several large Army bases. During the early years of the war he was special adviser to the Advisory Commission to the Council on National Defense and to the War Production Board in Washington. He attended the University of Illinois.

Joseph Z. Burgee

Milton Earl Chamberlain (A.M. '21), age 67, Lieutenant Colonel, U.S. Army Corps of Engineers (retired), and former consulting engineer of Rutherford, N.J., died at St. Petersburg, Fla., November 21. Mr. Chamberlain studied at Pennsylvania State College and was employed by Booth & Flinn Ltd., both before and after service in the Navy Civil Engineer Corps in World War I. In 1930 he went into private practice in Rutherford as a consulting engineer. Commissioned an officer in the Corps of Engineers in 1945, he retired in 1950 and returned to private practice.

Charles Albert Cummins (A.M. '16), age 74, consulting engineer and head of the Cummins Construction Co., of Baltimore, Md., died there on December 21. Mr. Cummins was instrumental in founding two of the largest building firms in the Baltimore area—the Consolidated Engineering Co. and the Cummins Construction Co.—and had built some of the South's earliest skyscrapers as well as extensive bridge, tunnel, and dam projects. Among his important projects were Camp Greene, N.C., the Department of Commerce Building in Washington, and many other large federal works. Mr. Cummins was a graduate of St. John's College, Annapolis.

Walter D. Dal Pizzol (J.M. '54), age 24, of New York City, died recently while serving in the U.S. Army as a private. Mr. Dal Pizzol was a civil engineering graduate of City College of New York, class of 1954.

Walter Devere Dent (A.M. '09), age 78, assistant treasurer and chief engineer of the Lockhart Power Co., Lockhart, S.C.,

(*Continued on page 90*)

2 NEW WIND-FREE PLUMMETS

Designed to replace the plumb bob • fully automatic • completely unaffected by the wind • efficient, practical time saver on every job • used and recommended by leading highway departments.

Telescoping Rod Type

- Made of aluminum alloy for accuracy and durability
- Absolute vertical within 1/16" plus or minus
- Fits standard tripods
- Adaptable to all recognized instruments
- Adjustable to hillside locations
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Automatic Optical Type

- Precision optical instrument
- Double image sighting system
- Self-leveling
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- Fits standard tripods
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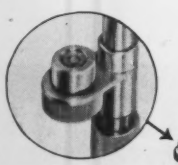

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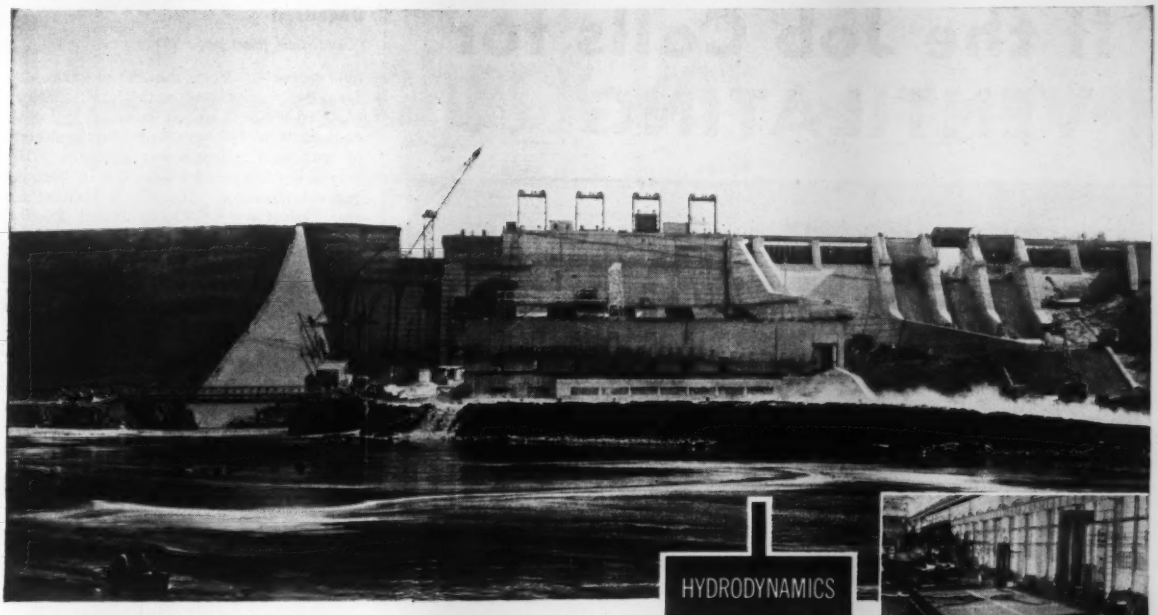
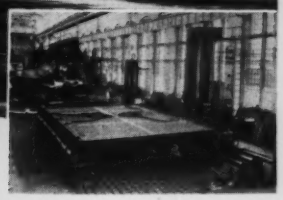


Looking upstream across the tailrace area, the SMS-Fixed Wheel Intake Gate on Unit #3 can be seen being lowered into position atop the dam.



Two halves of a gate have been assembled and aligned on a 7-inch bar horizontal boring mill. SMS bores wheel axle holes in this manner to assure accurate alignment within close tolerances.

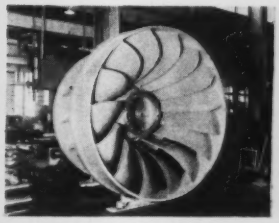
SMS-Francis Turbines At Littleton Development To

GENERATE PEAK POWER

To meet rapidly increasing demands within the New England Electric System's area, Moore Station near Littleton, New Hampshire, will soon go on the line delivering peak load power. Rated at 150,000 kw, this new hydro plant is the third and last on the Fifteen Mile Falls stretch of the Connecticut River. Including the Comerford and McIndoes Stations immediately downstream, this will give a total capacity of 310,000 kw in a river fall of 367 feet at this location. Thus the largest of New England's rivers becomes one of the most highly developed streams of its size.

All three of the Fifteen Mile Falls plants are powered by SMS turbines. The four Littleton units are the vertical Francis type, each rated at 56,400 HP under a 150-foot head. SMS also provided four 18-foot x 24-foot fixed wheel intake gates for operation with an 84-foot head on the sill of the gate frame. The gates are designed for closing under full discharge and opening under balanced hydraulic conditions.

These three plants, with both SMS-Francis and Kaplan turbines as well as accessories, illustrate S. Morgan Smith's ability to handle the needs of any hydro project. Over three quarters of a century's experience in hydraulic design and manufacture stand behind SMS equipment. For full information, write S. Morgan Smith Company, York, Pennsylvania.



Unit #3's runner, completed and ready for shipment.

The 198-inch diameter riveted plate steel spiral case (with riveted cover plates) for Unit #1, taken during assembly at SMS Plant #2.

S. MORGAN SMITH

AFFILIATE: S. MORGAN SMITH, CANADA, LIMITED, TORONTO

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. . . Your best bet is NAYLOR PIPE

When you consider ventilating lines, Naylor Spiralweld pipe stands out in two basic ways.

From a structural standpoint, the Naylor spiral truss adds extra safety and collapse strength for both pressure and vacuum service. Its exclusive structure permits the use of lighter gauge material for lower cost without sacrificing performance.

From an installation aspect, when connected with the one-piece Naylor Wedge-Lock coupling, Naylor lines can be installed faster than by any other method. With this combination, lines hug the wall and space is saved as they can be made up with only one side of the pipe in the open. And its light weight makes Naylor pipe easy to handle and extend as work progresses. Sizes from 4″ to 30″ in diameter and uniform lengths to 40 feet.

Write for Bulletins No. 507 and No. 514 for complete details.

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Eastern U. S. and Foreign Sales Office: 350 Madison Avenue, New York 17, New York

Deceased

(*Continued from page 88*)

died recently. For a number of years Mr. Dent was associated with J. E. Sirrine, of Greenville, S.C., working on the construction of power plants and the design of mill and water-power facilities. He joined the Lockhart Power Co. in 1916 as general manager. He was a student at the University of Georgia and Emory College.

James Lynn Dodge (M. '08), age 85, retired civil engineer of Bethesda, Md., died there on December 7. A graduate of Cornell University, class of 1894, Mr. Dodge was employed for many years by Westinghouse, Church, Kerr and Company of Philadelphia, Pa., on railway construction. He later designed and supervised the construction of a dam and irrigation system in Yolo County, California for E. L. Phillips and Co. From 1924 to 1934 he was division engineer for the Philadelphia Department of City Transit in charge of several sections of the city subway system. For the past 15 years he had been in the real estate business in Haddon Heights and Audubon, N.J., moving to Bethesda a year ago.

Theodore A. Grahlman (A.M. '20), age 67, retired civil engineer of Seattle, Wash., died there January 23. Mr. Grahlman went with the first geodetic survey party to Alaska in 1910. He was later employed by the Port of New York Authority and worked on the construction of the Holland Tunnel. In 1941 Mr. Grahlman went to Seattle, and was employed by City Light, the City Engineering Department, and the Pacific Testing Laboratory, before his retirement in 1953.

John Thornton Dean (A.M. '25), age 67, principal engineer of highways, New Jersey State Highway Department, Trenton, died at his home at Pennington, N.J., on January 7. A graduate of the University of Pennsylvania, class of 1910, Mr. Dean was for a number of years division engineer for the Delaware River Joint Toll Bridge Commission, Pennsylvania and New Jersey. Earlier he had been resident engineer for Burlington County, New Jersey, and construction engineer for the Dupont Engineering Co. at Nashville, Tenn.

Edward R. Heyl (A.M. '38), age 65, superintendent, Public Works Department, Philadelphia Navy Yard, for the past twenty years, died recently at his home at Mt. Holly, N.J. A graduate of Princeton University, class of 1911, Mr. Heyl was with the Pennsylvania Railroad from 1911 to 1927. In 1930 he became designing engineer for the Bureau of Engineering, Philadelphia, Pa., and in 1935 superintendent of the Public Works Department.

Frank Woodbury Jones (M. '44), age 69, partner in the Cleveland consulting firm of Havens & Emerson died at Garfield

(*Continued on page 92*)

Contractor's check list *for specifying* ASPHALT

1

CONVENIENT SHIPPING SOURCES

Standard has 5 centrally located shipping points in the Midwest:

Wood River, Ill.
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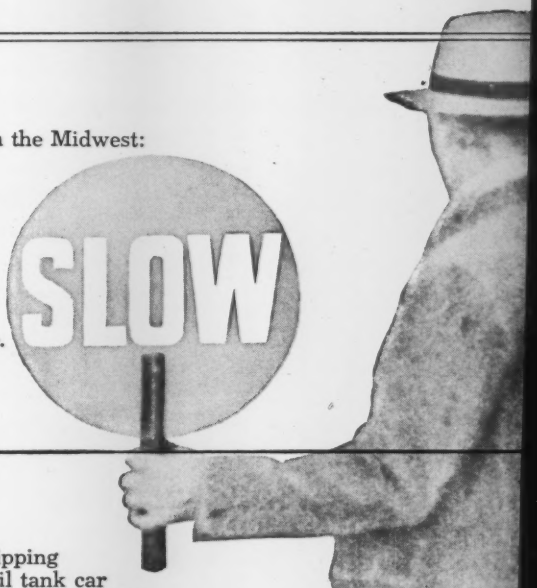
Asphalt from Standard Oil gets shipped to you direct from the shipping point nearest your job site. Shipments get to the site faster, keep you on schedule.



2

TANK CAR AND TANK TRUCK SHIPMENTS

Shipments can be made from any Standard Oil shipping point in either tank car or tank truck. Standard Oil tank car service keeps contractors supplied with asphalt at the rail head as needed. Tank truck deliveries permit shipment directly to the job site, often saving heat-up to unload, and making possible unloading directly at the batching plant.

3

RELIABLE SOURCE OF SUPPLY

A reliable source of supply means three things to a contractor:

1 A supplier that delivers according to contract *when needed.* Standard Oil recognizes this as a prime factor in contracting for asphalt, delivering as the contractor needs material.

2 A supplier familiar with the contractor's problems. Standard has been supplying asphalt to contractors in the Midwest for many years. Standard salesmen know contractor's problems . . . know how to give him service.

3 A contractor must have dependable sources of supply. Taking care of its customers through periods of short supply as well as delivering when materials are plentiful is the kind of service contractors need, want and get from Standard. With the big program of road construction now under way and promises of even bigger programs to come, an assured, dependable source of asphalt is a must for every road building contractor.

Check this list, then check with Standard. In the Midwest contact your nearby Standard Oil office. Or write, Standard Oil Company, 910 South Michigan Avenue, Chicago 80, Illinois.

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STANDARD OIL COMPANY (Indiana)

Have you seen the important NEW FEATURES on the WHITE Engineers' transit

YES, the White Engineers' Transit is a fine engineer's instrument — now made even finer with the addition of *covered leveling screws* and *coated optics*.

Covered leveling screws assure you of smooth, easy, precise leveling at all times, under all kinds of conditions for the life of the instrument itself.

Coated optics guarantee clear, sharp, accurate images — without halation, at longer distances, even under adverse conditions.

Compare the David White Engineers' Transit with all others—feature for feature — price for price. Compare them for accuracy — long durability — built-in quality. To meet your preference, this instrument is available with "U" or "A" type standards. You'll find you'll buy right when you buy a David White.

Contact our nearest dealer for complete details of the David White Engineers' Transit and for other fine Engineering Instruments—or write direct to David White, 309 W. Court St., Milwaukee, Wis.

DAVID WHITE COMPANY

We offer complete, prompt repair service on all makes of instruments — levels, transits, theodolites, etc.

Deceased

(*Continued from page 90*)

Heights, Ohio, November 17. A noted sanitary chemist and veteran operator of sewage works, Mr. Jones had been in consulting work since 1940. Educated at Worcester Polytechnic Institute, class of 1909, he taught there for two years after graduation. Chief engineer of the City of Cleveland and later chief sanitary chemist and superintendent, Mr. Jones was the creator of the informal Quarter Century Operators' Club of veterans of plant operation within the Federation of Sewage & Industrial Wastes Associations. He was the 1952 winner of the Charles Alvin Emerson Medal.

Thomas A. Jordan (M. '35), age 74, retired division engineer of the American Bridge Co., Chicago, Ill., died there recently. Mr. Jordan spent his entire career with the American Bridge Co., with which he became connected in 1910, upon his graduation from Michigan State College. For many years he was chief designing engineer in the Chicago office. He retired in 1946.

Frank R. Lanagan (M. '22), age 74, retired municipal engineer, died at Old Bennington, Vt., on December 15. Mr. Lanagan was city engineer of Albany, N.Y., from 1912 to 1922, when he established a private consulting practice. Later he was deputy engineer of New York State for two years, and city engineer of Schenectady, N.Y., for four years. He graduated from Rensselaer Polytechnic Institute in 1905.

Marvin Y. Neely (A.M. '19), age 65, Captain, U.S. Navy (retired) and general superintendent for John McShain, Inc., Philadelphia, Pa., died January 16. A graduate of the University of Pennsylvania, class of 1913, he served as a captain in the Army Corps of Engineers during World War I. For many years he was president of his own construction firm, M. Y. Neely, Inc., and secretary-treasurer of the Montgomery Paving Co., Philadelphia. He was in the Civil Engineer Corps of the Navy from 1942 until his retirement in 1951. Joining McShain, Inc., in the latter year, he had supervised all the concern's construction work in the Philadelphia area.

John Orr (M. '10), age 85, retired director of the Witwatersrand Technical College, Johannesburg, Union of South Africa, died there recently. A graduate of Glasgow University, Scotland, class of 1887, he was with various engineering firms in England before going to South Africa in 1897. He was professor of mechanical and electrical engineering at the South African School of Mines before going to Witwatersrand in 1903. Upon Professor Orr's retirement in 1945, the college honored him for his contributions to engineering education in South Africa.

Charles Wilmer Snyder (A.M. '36), age 51, partner in the firm of Crout, Snyder & Crandall, structural engineers of Balti-

(*Continued on page 96*)

CONCRETE FRAMES AND FLOORS

Quality construction for Modern Office Buildings

These photos of the Simms Building in Albuquerque, New Mexico show the use of reinforced concrete frame and floor construction adapted to a modern office building. The first floor covers an entire city block and is surmounted by a 12-story structure and penthouse.

There are many reasons for the growing popularity of concrete frame and floor construction. It offers great strength, unusual durability, firesafety and economy. Its moderate first cost, low maintenance cost and long life add up to ***low annual cost,*** which pleases owners and investors. And competitive bids show that this method saves up to 40% on frame and floor cost.

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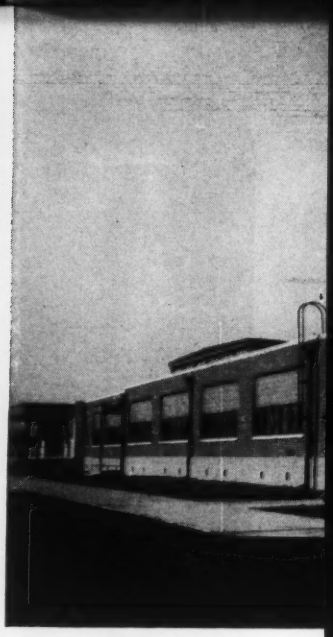
Upper photo shows 12-story section of Simms Building above the roof of block-square first floor. The floors throughout are 6-in. thick reinforced concrete using a wide beam design and cantilevered 5 ft. outside the supporting columns. Architects and engineers: Flatow-Jason Moore. Contractor: Lembke, Clough & King, Inc. Both of Albuquerque.

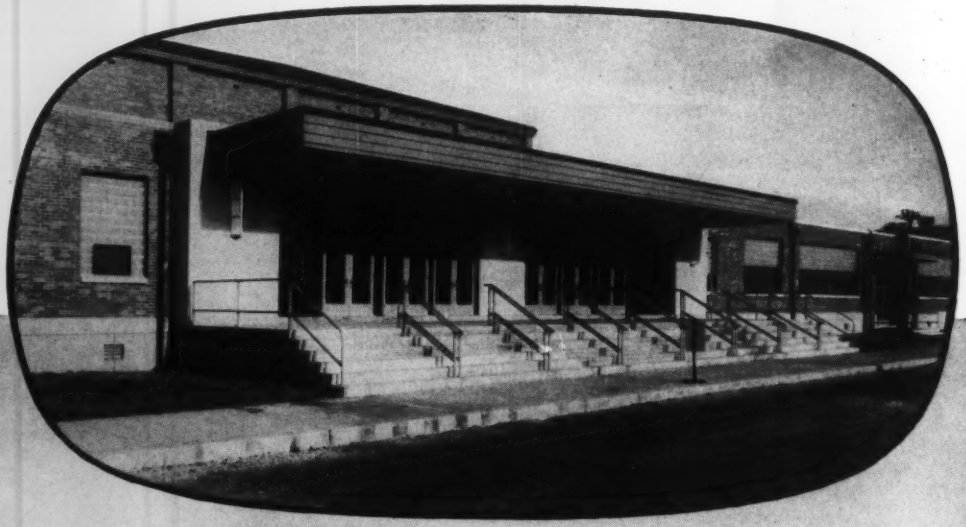
THE MAIN ENTRANCE of Assumption High School. The architects were Paul J. Saunders and Eugene S. Johnson. The engineer was John P. Nix. The general contractor was Wm H. and Nelson Cunliff Co.

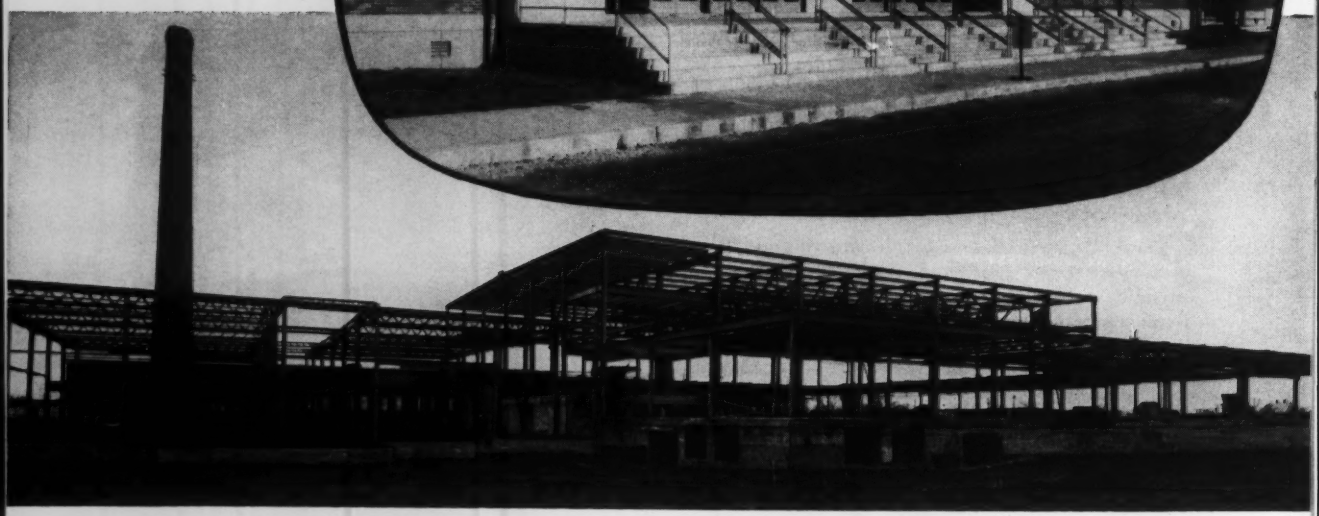


TWO STORY ACADEMIC UNIT, connected to the one story unit to which a second floor may be added in the future.

New High School designed with

ENTRANCE to the gymnasium unit. The small doorway to the right leads into a classroom area.





THE STRUCTURAL FRAMEWORK during erection. The more than 348 tons of USS Structural Steel, used in the building, were fabricated by The Mississippi Valley Structural Steel Co., St. Louis, Mo.

future expansion in mind

The Assumption High School of East St. Louis, Illinois, was built to accommodate 650 students with provisions for expanding horizontally and vertically to provide facilities for an eventual one thousand students.

The school consists of three units: an academic unit containing classrooms; a gymnasium unit including gymnasium, cafeteria, shops, and laboratories; and a Brother's House, independent of the other buildings, which contains living quarters for 24 Brothers. The academic unit has provisions for expansion to the east. In addition, a second floor can be added to the present one story portion. The Gymnasium Unit is designed so that there is sufficient physical education, shop, laboratory, and cafeteria space for additional students if classroom facilities are increased.

Structural Steel was used exclusively in the framing of this new school because of its versatility, its tremendous load bearing capacity, and its economy of use—qualities that make it ideal for *all* types of school construction. Small wonder that today's architects and engineers are specifying Structural Steel frameworks for more and more schools, churches, and small buildings. Just look at these advantages:

1. Structural Steel is the strongest, yet most economical of load bearing materials.

2. Structural Steel will withstand more abuse than other structural materials, effectively resisting torsion, tension, compression, and shear.

3. Once enclosed in buildings, it lasts indefinitely—requiring no maintenance.

4. Structural Steel may be riveted, bolted or welded . . . can be erected in any weather in which men can work.

5. Steel members are fabricated indoors; therefore, weather can have no effect on the quality of workmanship.

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WET JOBS

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Toronto Montreal Halifax

Deceased

(*Continued from page 92*)

more, Md., died recently. Mr. Snyder graduated from the Baltimore Polytechnic Institute, class of 1930, and also studied at Johns Hopkins University. He was associated with Herman F. Doeleman, consulting engineer, as draftsman and designer for several years, and was chief engineer for the Acme Steel Engineering Co., Baltimore, in complete charge of design of structural steel work for buildings and bridges. For the past eighteen years he had been in practice in Baltimore.

Alfred Campbell Speight (M. '53), age 67, former mayor of Gladstone, N.J., and construction superintendent for the Bakelite Co., Bound Brook, N.J., died recently at his home at Gladstone. Mr. Speight joined Bakelite in 1933 after several years service as construction engineer with the Hercules Powder Co. in Wilmington, Del. He served three terms as councilman of Peapack and Gladstone and three terms as mayor.

Charles B. Spencer (M. '28), age 69, chairman of the board and former president of Spencer, White & Prentis, Inc., New York City building firm, died in New York on January 7. Mr. Spencer was consulting engineer on the foundations and steel work for the renovation of the White House completed in 1952, and his firm did part of the construction work. Among the firm's other important projects were work on the Independent subway system in New York, the foundation for the Cleveland Union Terminal, locks and dams on the Mississippi, and a wide variety of World War II building structures. Mr. Spencer was one of the founders of the firm in 1919. A graduate of Columbia University, Mr. Spencer was holder of the Columbia Alumni Medal for conspicuous service and of its Egleston Medal for outstanding engineering achievement. He won the Moles Award in 1950.

Charles B. Spencer

John Courtney Wenrick (M. '42), age 63, Cleveland commissioner of engineering and construction, died October 30. Mr. Wenrick had been in the city's engineering department since 1922 and commissioner of engineering and construction since 1939. Before joining the city's engineering staff, he was president and treasurer of his own contracting company. Mr. Wenrick was a graduate of Case School of Applied Science, and an Army veteran of World War I.

Winsor D. Wilkinson (A.M. '24), age 68, Captain, Field Artillery, U.S. Army, died at his home in Berkeley, Calif., on October 4. A graduate of Dartmouth College, class of 1910, Mr. Wilkinson studied sanitary engineering at the University of California later and worked on highway, dam, and levee construction in California. He entered the U.S. Army Field Artillery in 1917, becoming a second lieutenant. He was associated with the San Francisco Bay Exposition Co., of San Francisco, before returning to the army in 1935.

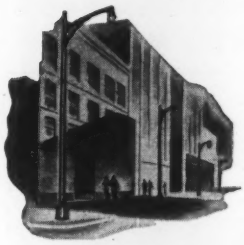
Richard Charles White (M. '43), age 70, consulting engineer and former city engineer of Buffalo, N.Y., died there November 5. A graduate of the U.S. Naval Academy in 1908, Mr. White served in the Navy as electric engineer officer for four years, returning in 1917 as aide to the Commandant, 5th Naval District. He had been with Mosier & Summers, Inc., Buffalo, for seven years, and chief engineer of the John Johnson Construction Co., Buffalo. He was city engineer of Buffalo from 1942 to 1945, and later was chief engineer for the Grade Crossing & Terminal Commission.

Albert Harrison Worley (A.M. '11), age 73, retired structural engineer of Kansas city, Kans., died there recently. A graduate of Kansas State University, class of 1903, Mr. Worley was for a number of years senior structural engineer, Western Division of Valuation, Interstate Commerce Commission in Kansas and, later, was transferred to Washington, D. C. He retired from practice several years ago.

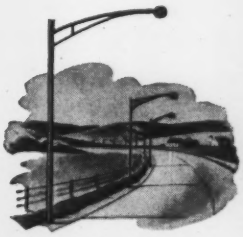
Frank Wormald (A.M. '50), age 40, structural designer with Washington & Spitzer, structural engineers of San Francisco, Calif., since 1949, died recently. He was a graduate of City College of New York, class of 1939, and received graduate degrees later from the University of California. Mr. Wormald had taught at both Universities and served during the entire war as a naval architect at the Mare Island (Calif.) Navy Yard.

Harold G. Wynne (M. '24), age 69, consulting engineer of New Haven, Conn., died there on December 5. Mr. Wynne was assistant engineer for the New Haven Bureau of Engineering from 1917 to 1928, leaving to open a private consulting practice. Later he was senior engineer for the State Department of Public Works, Hartford, and engineer for the Department of State Police. In recent years Mr. Wynne had lectured to architectural students at Yale University in surveying, drafting and lay-out planning.

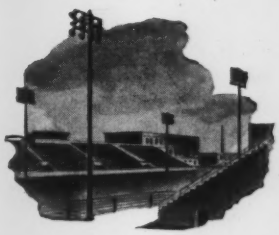
Robert Ernest Wright (A.M. '34), age 62, engineer of Sierra Madre, Calif., died recently. He studied at the California Institute of Technology, Pasadena Calif. Mr. Wright was a mechanical engineer with the U.S. Navy and during the war served as lieutenant in the U. S. Naval Reserve. For many years in private practice, Mr. Wright specialized in design and construction of light steel buildings, both residential and industrial types. He had been president of the Regional Planning Congress of Los Angeles and chairman of the Sierra Madre City Planning Commission.



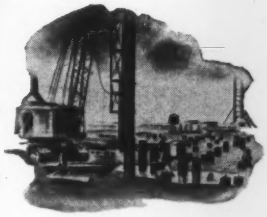
Street Lighting Poles



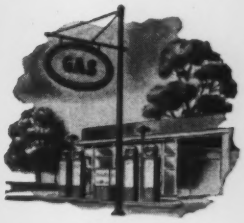
Highway Lighting Poles



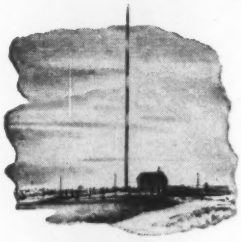
Floodlighting Poles



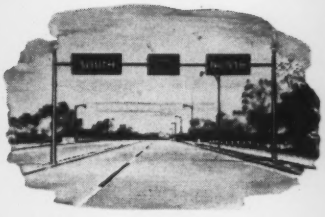
Foundation Piles



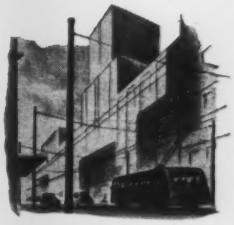
Sign Poles



Antenna Poles



Overhead Sign Supports



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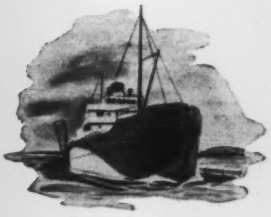
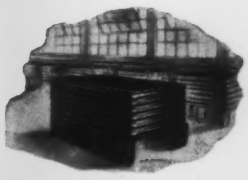


Booms and Masts



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Mechanical Contractor: Bass Construction Co.

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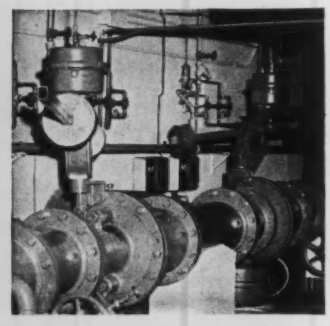
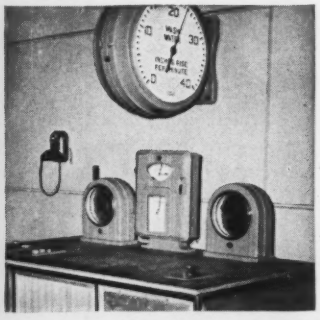
Results: Rate of flow, loss of head and water levels are indicated and recorded, with total plant flow summated, *at one central table* that operates all filters at optimum rates.



Filter gallery: Diaphragm pots for Master Pneumatic System are just above counterbalanced arms of the Simplex Controllers.



At this one table, Simplex pneumatic receivers give centralized measurement of summated plant output and centralized control of flow.

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Non-ASCE Meetings

American Congress on Surveying and Mapping. Sixteenth annual meeting, Shoreham Hotel, Washington, D.C., March 18–21. For information contact Franklin G. Williams, chairman, ACSM, 5514 Nevada Avenue, N. W., Washington, D.C.

American Institute of Steel Construction. Eighth annual national engineering conference at Lehigh University, Bethlehem, Pa., April 4–6. Further information from AISC, 101 Park Avenue, New York 17, N.Y.

American Society of Photogrammetry. Twenty-second annual meeting, Shoreham Hotel, Washington, D.C., March 21–24. Information from William A. Radlinski, chairman, ASP, 1719 Keokee Street, Hyattsville, Md.

American Water Works Association. Diamond jubilee conference, St. Louis, Mo., May 6–11. All reservations will be cleared through the AWWA office, 521 Fifth Avenue, New York 17, N.Y.

American Welding Society. National Spring Meeting, Hotel Statler, Buffalo, N.Y., May 7–11. Information from AWS, 33 W. 39th Street, New York 18, N. Y.

International Electro-Technical Commission. International conference on large electric systems, 16th Convention of International Conference, Paris, France, May 30–June 9. Further information from Mr. P. Sporn, 30 Church Street, New York City, N.Y.

University of California. Conference on Marine Corrosion and Fouling Problems. LaJolla Campus, Los Angeles, Calif., April 18–19–20. Information from University of California Engineering Extension, Los Angeles 24, Calif.

University of Florida. The ninth Municipal and Sanitary Engineering Conference, Gainesville, Fla., April 17–18. Further information, Dr. E. R. Hendrickson, conference chairman, University of Florida, Gainesville, Fla.

University of North Carolina. Fifth Southern Municipal and Industrial Waste Conference, Chapel Hill, N.C., April 5–6. For information write D. A. Okun, Dept. of Sanitary Engineering, University of North Carolina, Chapel Hill, N.C.

World Power Conference. Fifth World Power Conference, Vienna, Austria, June 17–23. Further information from U. S. National Committee, Stewart E. Reimer, Secy., c/o Engineers Joint Council, 29 West 39th Street, New York 18, N.Y.

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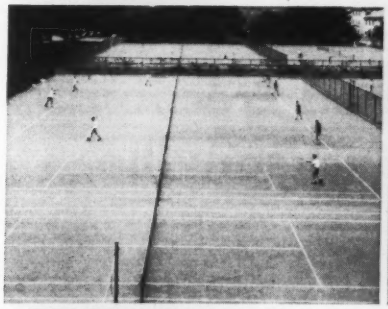

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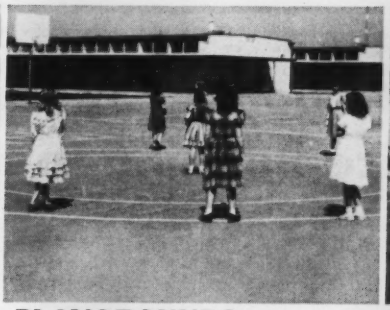

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Leading Marketers of Asphalts, Cutbacks, and Emulsions — Nationwide.

Thousands of Bethlehem High-Strength Bolts were used to join structural members in framework for new Prudential office building in Jacksonville, Fla. *Architects:* Kemp, Bunch and Jackson. *Contractor:* Daniel Construction Company of Alabama. *Fabricator and Erector:* Ingalls Iron Works Company.

High-Strength Bolting Speeded Erection of New Office Building in Jacksonville

This handsome building encased in marble, limestone and pink granite is the South-Central headquarters of The Prudential Insurance Company of America, at Jacksonville, Fla. The 22-story structure has a steel framework of 5,893 tons, held together with thousands of Bethlehem High-Strength Bolts. This method of construction saved erection time, as the bolting was completed within a week after the last piece of steel was set.

High-strength bolting is rapidly increasing in popularity as a means of erecting steelwork economically. Bolted joints are made rapidly. The bolts, used with hardened washers, can be installed in seconds. A holding wrench grasps the bolt-head, and the nut is driven to predetermined tension with a calibrated pneumatic impact wrench. That's all there is to it! There's no fire hazard involved. Besides, the bolting operation is less noisy than riveting, making it more suitable for use in hospital and school zones.

Bethlehem High-Strength Bolts are made of carbon steel, and come in sizes to meet virtually every construction need. They are heat-treated by quenching and tempering, and meet every requirement of ASTM Specification A-325.

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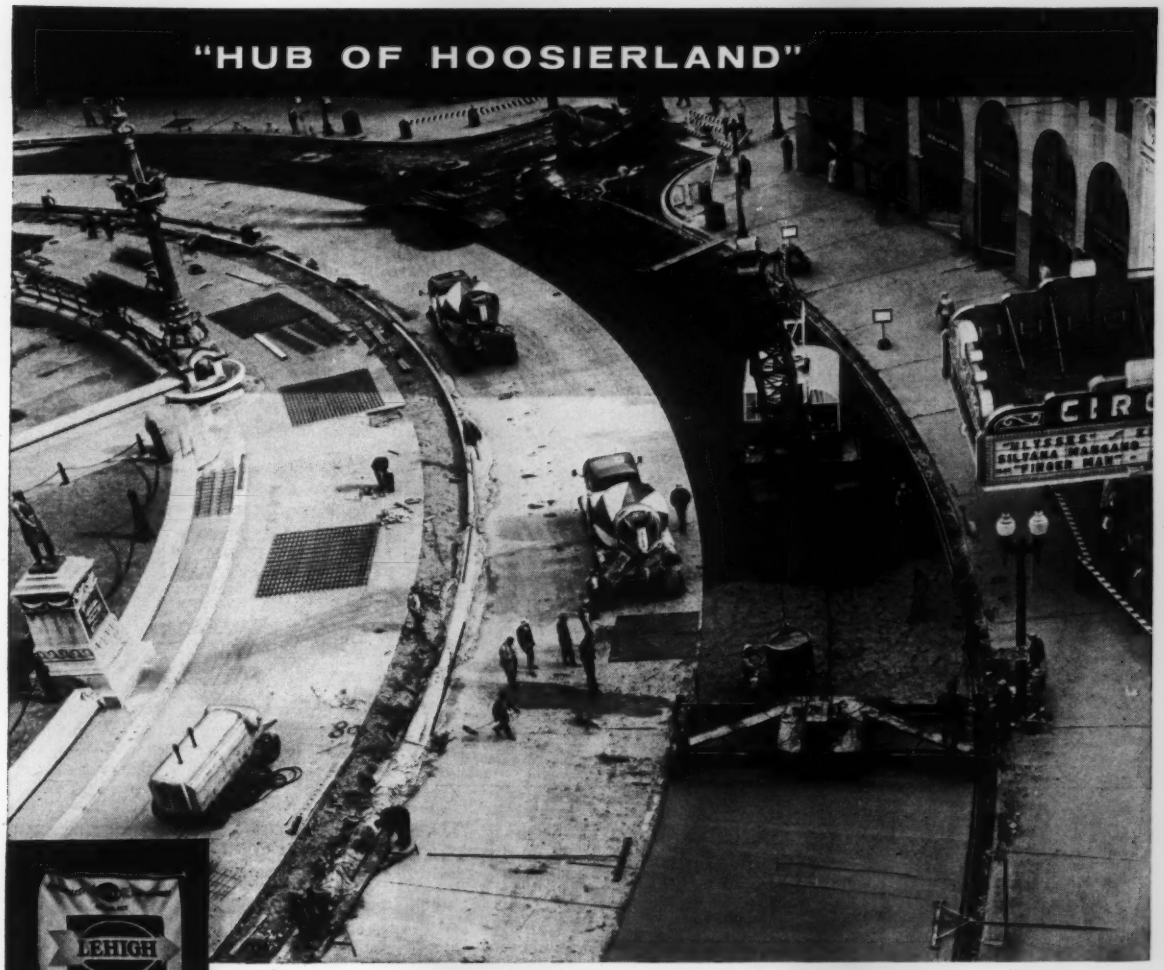


Monument Circle, mid-town Indianapolis
Owner: STATE HIGHWAY DEPARTMENT OF INDIANA
Contractor: SMITH AND JOHNSON, INC., Indianapolis
Concrete supplied by: READY MIXED CONCRETE CORP., Indianapolis

Repaved **FAST** with Lehigh Early Strength Cement

Famous Monument Circle in Indianapolis needed repaving . . . with long life, low annual cost material . . . in the shortest possible time with the least inconvenience to the public.

This was accomplished through careful planning, fast modern construction methods—and the use of durable quick-curing concrete made with Lehigh Early Strength Cement.

For example, three days after a pour—less than half the usual time—heavy transit mixers were on the new section delivering concrete for the next pour. And in spite of bad weather throughout the job, the contractor saved seven days construction time.

Right for repaving the "Hub of Hoosierland," Lehigh Early Strength Cement may be *right* for your next job.

•LEHIGH EARLY STRENGTH CEMENT •LEHIGH PORTLAND CEMENT
•LEHIGH AIR-ENTRAINING CEMENTS •LEHIGH MORTAR CEMENT

LEHIGH PORTLAND CEMENT COMPANY
ALLENTOWN, PA.

If the doctors were to engage in competitive bidding

TO THE EDITOR: The article, "Competitive Bidding," by Raymond A. Hill, M. ASCE, in the August 1955 issue, has stimulated the following reflections on the so-called ethical practices of engineers and architects:

News item

(*Strictly Fictitious*)

"The Executive Committee of the American Medical Association yesterday adopted a resolution declaring that the old-fashioned methods of the medical profession in sales promotion, advertising, and public relations are outmoded, and recommended adoption by the profession of modern business practices patterned after those followed by the professions of architecture and engineering."

There follows a

Proposal

(*Here condensed from the original which is 46 pages long, including graphs, charts, tables, photographs, and testimonials.*)

"HONORABLE COMMISSIONER:

"In response to your invitation for ten medical and surgical organizations to submit proposals covering necessary professional services required for the rehabilitation of your liver and appurtenant work, we are pleased to submit herewith our proposal. Also included is organizational and experience information to indicate the extent of our qualifications for this type of work.

"If you should decide to retain our services for this work, it is our intention to set up a completely equipped branch office and field laboratory in your city, with a chief surgeon in full-time charge, and a competent staff of technical assistants. Our chief surgeon will be available at all times for conferences and to explain technical details of the work to all interested parties.

"*Organization.* Our table of organization lists one hundred physicians and surgeons, some of whom you have read about in the newspapers, who specialize in every ailment of the human body and in some which have not yet been released to the general public. Besides that, we have any quantity of bookkeepers, typists, and other common people on our expensive payroll. Attached is a photo of our new eleven-story main office building.

"*Experience.* We are awfully modest but we feel that we must admit that of all the things we are good at, the best of all is livers. In fact you might almost say we love livers; we think about them all day and dream about them at night.

"Ever since the founder of our firm invented little liver pills almost a century ago, the world has looked up to us in awe as the authority on livers. Attached is a whole stack of clippings describing the magnificent work we have done with livers. We proudly enclose a photostat of a letter of commendation from the War Department crediting us with promoting the war effort by rehabilitating the livers of 40 colonels in one year at the Pentagon alone.

"Also, we have had prepared at great expense a colored three-dimensional moving picture showing the details of our most famous liver rehabilitations, available for group gatherings.

"*Scope of the work.* If we are awarded the job, we propose to work over your old liver so that it will be hardly recognizable. When we get through with it, it should function satisfactorily for another fifty years, with only routine maintenance.

"Besides that, we will give you absolutely free an injection of goat glands extract, newly developed by our laboratories, not available anywhere else, at absolutely no charge.

"*Fee.* Our fees are based on the standards of the American Medical Association, but because we are fascinated by your interesting problems, we will reduce our normal fee by one-half percent.

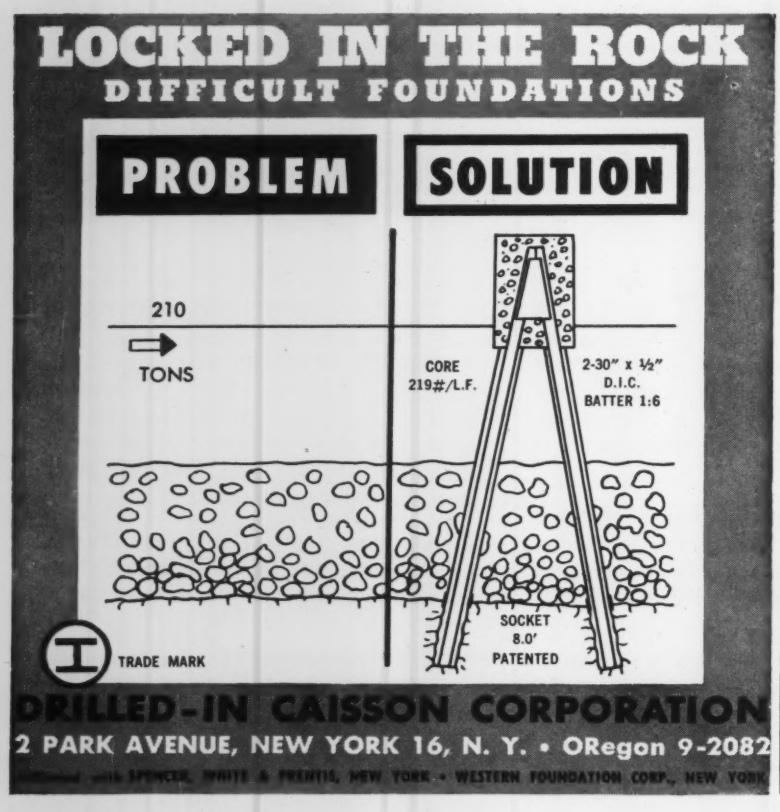
"We realize that financing of the work must first be arranged for by a bond issue; therefore we agree that in case the bond issue fails or if nobody will buy your bonds, there will be no obligation to pay us at all."

Results: The Commissioner's family expresses thanks for all the nice flowers.

Spoofingly submitted,

J. VANTEYLINGEN, Mem. AIA
WILLIAM J. WENZEL, M. ASCE

Great Falls, Mont.



Sea radar tower vulnerable to attack

TO THE EDITOR: I have read with interest the story about "The First Atlantic Radar Platform," by Gordon F. A. Fletcher in the January issue, and am concerned about the safety of this structure. It is completely defenseless and cannot offer shelter to any craft. One leg could easily be broken by a floating mine, submarine attack, or suicidal ramming by some wartime vessel, or by radar-controlled torpedoes. Even in peacetime if an ocean liner by mistake hits one leg or a disabled vessel drifts against one leg, this

(*Continued on page 104*)

Here's Paul and Richard Slattery's new HD-11, pulling a 7½-yd Allis-Chalmers scraper on an eleven-mile road-rebuilding job between Savannah and Whitesville, Missouri.

Allis-Chalmers HD-11 Crawler Tractor

"BIG PERFORMER"

says Missouri contractor

That's co-owner Dick Slattery talking about the newest addition to his spread of Allis-Chalmers equipment.

"The HD-11 has given excellent performance and requires little maintenance," Dick goes on. "Among a lot of good things, I think the engine is tops. The lower RPM for one thing will give the tractor longer life. And its lugging power is terrific."

Chalk up another enthusiastic user of the new HD-11. And Dick knows what he's talking about. He started in business building farm ponds and clearing land with an army surplus Allis-Chalmers tractor in 1946. Now, with his father, he owns three crawlers, two big motor graders and a 7.5-yd scraper — all Allis-Chalmers.

Stop at your Allis-Chalmers Construction Machinery Dealer . . . see for yourself why the great new HD-11 is making such an impression on dirt movers like Dick Slattery.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

ALLIS-CHALMERS

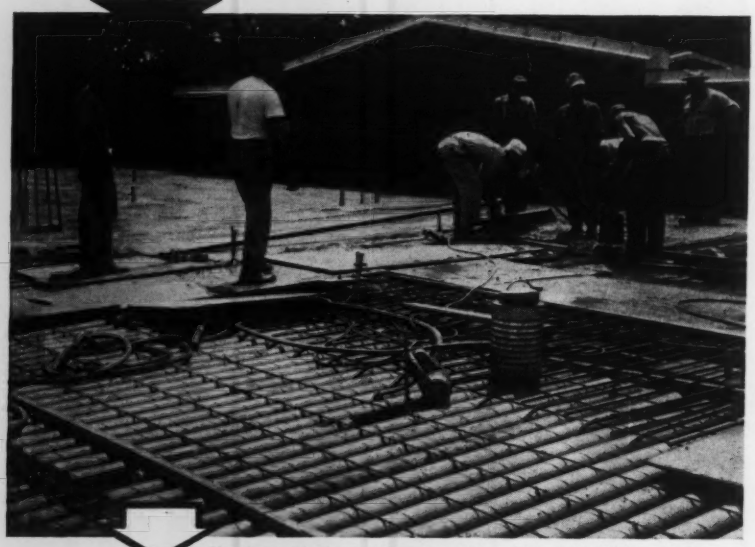
HD-11 owners know you just can't beat the combination of advanced-design features the HD-11 offers. The new engine with "follow-through" combustion . . . new long-life, ceramic-lined clutch . . . tough new track . . . all-steel box-A main frame . . . unit construction . . . lube features that let you leave a grease gun home for one to two weeks . . . these are just some of the many advantages that together add up to the finest tractor in its class.

HD-11
75 drawbar hp
20,500 lb

HD-11G
105 net engine hp
32,000 lb
2¼-yd bucket capacity

SONOVOIDS.®

reduce cost of floor and roof slabs!



Veterinary Diagnostic Laboratory, Iowa State College, Ames, Iowa. James A. Dougher, Architect, Des Moines. W. A. Klinger Co., Contractor, Sioux City.

SONOVOID® FIBRE TUBES

for voids in concrete construction

Floor and roof slabs in this Iowa State College building contain voids created by SONOVOID Fibre Tubes. Slab weight was reduced which resulted in a savings on concrete and steel. Structural strength was not impaired.

Metal end closures were used in the SONOVOIDS and they were "tied" down by means of light weight steel reinforcing rods with spacers attached (see photo).

Easy to handle, low cost SONOVOIDS save time, materials and money. Use SONOVOIDS in concrete bridge decks, wall, floor, roof and lift slabs; also in concrete piles. For prestressed or poststressed precast units or units cast in place.

Available in lengths up to 50 feet or can be sawed to your requirements on the job, size 2.25" to 36.9" O.D. End closures available.

For complete technical information and prices . . . write

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SONOCO PRODUCTS COMPANY

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AKRON, IND. • LONGVIEW, TEXAS • BRANTFORD, ONT • MEXICO, D. F.

The Readers Write . . .

(This department begins on page 60)

(*Continued from page 102*)

leg will break and the tower will collapse, destroying the vessel with it.

If only one leg is broken, the deck will take a nearly vertical position before the whole deck practically disappears into the ocean. All the occupants will slide off into the ocean or be trapped in various rooms and drowned. There will be no chance for rescue. There is less chance for rescue than on a sinking ocean liner because failure would occur within a period measured in parts of a second.

This tower can be rendered safe if certain changes are made. Here are a few suggestions:

1. Enclose all sides from the bottom up with a wall of concrete about 2 ft thick.
2. Fill the inside with stone and sand within 15 ft of mean water level, thus providing an enclosed harbor.
3. On all sides of this enclosure provide large doors to extend 15 ft below water level. The door on the lee side could be opened to allow small sea craft to enter. At other times the doors would always be kept closed.

Thus a safe method would be provided for sea travel to and from the tower, as well as an ideal harbor for small craft, as for instance submarines, PT-boats, and vessels used for contact with the mainland. This suggested wall enclosing a sand and rock fill, properly braced, would make the tower practically indestructible. The concrete walls would be cast in sections on shore and towed out on pontoons. Construction of this type would be less costly—and much safer.

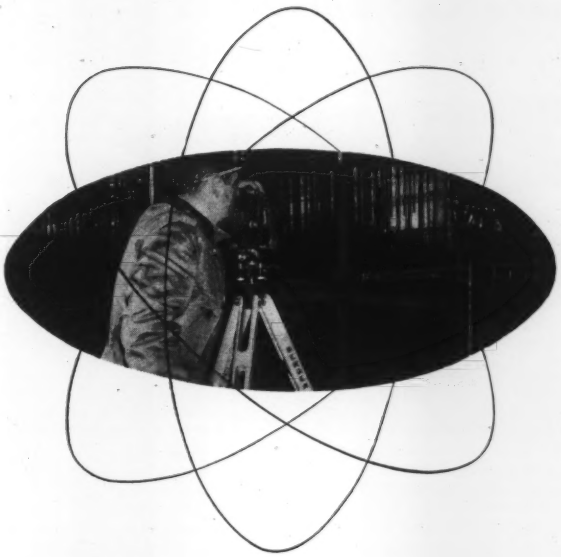
ODD ALBERT, A.M. ASCE
Associate Prof. of Civil Eng., Brooklyn Polytechnic Inst.
Brooklyn, N.Y.

Where is the largest siphon spillway?

TO THE EDITOR: About four years ago the Portland General Electric Company built a siphon spillway near Portland, Oreg. This spillway, designed by our firm, has a crest length of 35.6 ft and a crest height of 9.0 ft. Its nominal discharge capacity is 7,000 cfs under a head of 16 ft, forebay to tailwater.

We are interested to know how this spillway stacks up for size and capacity with other siphon spillways in the United States or elsewhere. Any information on this subject would be appreciated by the undersigned.

J. C. STEVENS, *Past-President, ASCE*
Stevens & Thompson
600 National Bldg.
Portland 4, Oreg.



Gilbane lays out new atomic vistas for Tracerlab with BERGER TRANSITS

"Tracerlab, Inc.", suggests a Reader's Digest article, "may turn out to be the General Motors of the atomic era". One of America's leading pioneers of instruments that detect the path of radioactive isotopes, Tracerlab has been making news on medical and industrial fronts since the end of World War II.

Naturally, Tracerlab's big new plant in Waltham, Mass., called for the highest standards of accuracy in every stage of construction. That's why Gilbane Building Company engineers saw it as another job for the BERGER 6¼" Bronze Transit—just as they did for so many other Gilbane projects where on-the-button surveying was a "must".

Results? Pin-point precision up and down the line of sight—from the initial excavating . . . to setting the concrete forms . . . leveling the foundation . . . plumbing the steel and setting room and floor deflection allowances to close tolerances.

BERGER is on the job for many other major Gilbane projects. Among the most recent: the huge new Wyman-Gordon plant at North Grafton, Mass., and the new Carling Brewery in Natick, Mass.

For clarity of optics, ease of leveling up and all-around dependability under even the most adverse conditions, leading engineers and construction men buy BERGER.

Put yourself behind a BERGER—and see why.

C. L. BERGER & SONS, INC., 51 Williams St., Boston 19, Mass.

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A rapidly expanding highway program offers:

- Permanent civil service positions
- Rapid advancement
- Challenging work

Starting salary based on experience

Civil engineering degree or professional registration required.

Write to:

Personnel Officer
State Highway Commission of Wisconsin
State Office Building
Madison 2, Wisconsin

To the Executive Secretary of ASCE
33 West 39th Street, New York 18, N.Y.

☐ I wish to take part in the work of the Pipeline Committee.

☐ I volunteer as a worker on the following sub-committee:

.....

☐ I volunteer as a speaker on the following subject:

.....

☐ I suggest the following as a speaker and subject:

.....

☐ Attached are my suggestions for future programs, speakers, other activities, possible new members, or informative data for your files.

☐ I am in favor of a new Pipeline Division.

☐ If a new Pipeline Division is formed, please enroll me.

☐ I am now enrolled in the..... Division.

Signed:.....Grade:.....

Address:.....

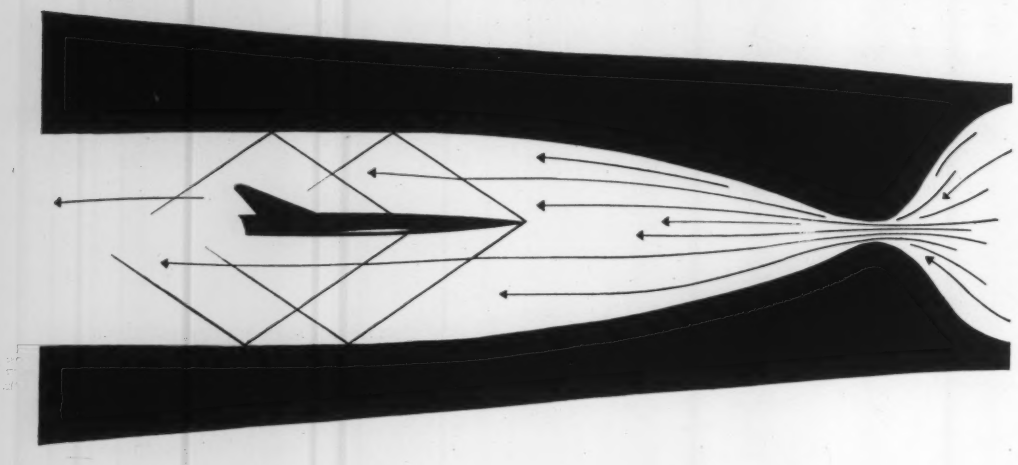
.....

Company:.....

Title:.....

Nature of position:.....

Guided Missile Engineers and Scientists



BUILD YOUR FUTURE IN A PRIME WEAPONS SYSTEM PROJECT...

The SM-64 Navaho Intercontinental Guided Missile

North American Aviation has prime weapons system responsibility for the SM-64 NAVAHO. This missile program is one of our country's largest, most important armament projects . . . a vital part of future defense planning. . . . . offering you long-term security, plus the opportunity to enrich your experience and capabilities in many advanced scientific and technical fields.

North American is actively engaged in **all** phases of research, design, development and manufacture of missile airframes and the operational testing of complete missile units. For instance, more than 100 separate projects make-up the NAVAHO effort. Your special training and abilities can be vital to the success of one or more of these intellectually-demanding projects. Your advancement depends only on your ability.

Military security prevents more adequate description of the NAVAHO and other missile studies and proposals in development at North American. For a fuller explanation of the opportunities open to you, please contact North American's Missile Development Engineering.

IMMEDIATE OPENINGS FOR:

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AEROTHERMODYNAMICISTS
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AIR FRAME DESIGNERS
MECHANICAL & ELECTRICAL DESIGNERS
INSTRUMENTATION ENGINEERS
ENGINE SYSTEMS ENGINEERS
STRESS & STRUCTURES ENGINEERS
RELIABILITY ENGINEERS
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HYDRAULIC, PNEUMATIC & SERVO ENGINEERS

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Engineering Personnel Office Dept. 91-20 CIV
12214 Lakewood Blvd., Downey, California

NORTH AMERICAN AVIATION, INC.

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This placement service is available to members of the Four Founder Societies. If placed as a result of these listings, the applicant agrees to pay a fee at rates listed by the service. These rates—established to maintain an efficient nonprofit personnel service—are available upon request. The same rule for payment of fees applies to registrants who advertise in these columns. All replies should be addressed to the key numbers indicated and mailed to the New York Office. Please enclose six cents in postage to cover cost of mailing and return of application. A weekly bulletin of engineering positions open is available to members of the cooperating societies at a subscription rate of $3.50 per quarter or $12 per annum, payable in advance.

Men Available

CIVIL-MINING ENGINEER; J.M. ASCE; 26; married; one child; U.S. citizen; BSCE; 6 years' varied experience underground hardrock mining, triangulation, Corps of Engineers construction work, industrial plant operations. Desires responsible position in mining or construction, Western U.S. or foreign. Employed but available on short notice. C-114-12-San Francisco.

CIVIL ENGINEER; J.M. ASCE; 20 years' varied office and field experience in highways, bridges, and buildings. Predominant experience has been on structural design and writing structural and architectural specifications. Also engineer for contractor preparing estimates for competitive bidding. Desires responsible position with architect-engineer or engineering firm. C-115.

SANITARY ENGINEER; J.M. ASCE; BSCE, M.S. Sanitary Engineering; 25; married; veteran. One year's experience with municipal utility and one year's experience surveying. Would like position in municipal management or engineering. C-116.

BUILDING CONSTRUCTION ENGINEER; M. ASCE; licensed professional engineer in New York. Experienced, banks, hospitals, office buildings, new and alterations; checking estimates, coordinating subcontractors, negotiating contracts. C-117.

MUNICIPAL OR CHIEF ENGINEER; A.M. ASCE; B.S.; 56; over 30 years' experience in responsible municipal and industrial design, construction administration. Will relocate. Desires active charge. Now employed. C-118-419-Chicago.

CIVIL ENGINEER; A.M. ASCE; BSCE, 1949; 38; married; 5½ years' experience with railroad on bridge construction, main line changes, and division office; 1½ years' experience as engineer in charge of large development program in southern Louisiana. C-119.

ASSOCIATE PROFESSOR; J.M. ASCE; B.S., M.S.; registered engineer; 5 years' teaching experience; 5 years' industrial experience, in the field of soils engineering, steel and concrete design. Desires full-time position in the Middle Atlantic Seaboard area. Particularly interested in opportunity to develop soil mechanics courses and laboratory. Available summer of 1956. C-120.

Positions Available

SENIOR HYDRAULIC ENGINEER, graduate civil, with 3 years' experience in hydraulic engineering including problems in hydraulics and design of hydraulic structures; experience in hydraulic laboratory testing of models desirable; writing of technical reports on related works. Salary, $4,980-$6,180 a year. Location, New Jersey. W-1738.

SALES ENGINEERS, 27–35, civil graduates, with concrete experience, for technical field work with customers of cement manufacturer. Salary, $4,800-$6,000 a year. Location, Northeast. W-2165.

ADMINISTRATIVE ASSISTANT TO GENERAL MANAGER for firm of general contractors; graduate civil, with 5 to 10 years' experience in heavy and highway construction. Both office and field experience desirable. Salary open. Location, Nebraska. W-2650.

ENGINEERS. (*a*) Field Engineer, civil graduate, preferably with professional license and resident engineering experience on industrial and process construction projects, to supervise layout, schedules, costs, interpretations, and revisions of plans and specifications and subcontracting. Salary, $8,400–$10,400 a year. Location, Indiana. (*b*) Office Engineer, 35–50, mechanical degree, with heavy industrial equipment experience covering design, specifications, and manufacture of machinery for office duties and supervision of field inspection covering purchase of metallurgical and chemical process equipment. Salary, $9,000–$12,000 a year. Location, Pittsburgh, Pa. W-2652.

ESTIMATORS. (*a*) Senior Construction Estimator, under 50, engineering degree, with at least 8 years' supervisory estimating experience covering heavy construction, foundations, mill buildings. Salary, $8,400–$12,000 a year. (*b*) Estimator, under 50, engineering degree, with quantity take-off, pricing of materials and labor on industrial or heavy construction projects. Salary, $5,000–$8,400 a year. Location, West Coast. W-2654.

STRUCTURAL PROJECT ENGINEER with a minimum of 5 years' experience in supervising design of small to medium bridges and building projects, for a consultant. Location, eastern Pennsylvania. W-2683.

ASSISTANT ENGINEER, young, graduate civil, to be assistant to town engineer. Should have considerable knowledge of problems and proper procedures involved in making engineering surveys; taking field notes; preparation of routine construction plans and specifications; drafting engineering notes and plans, etc. Salary, $4,800–$5,200 a year. Must be resident of New Jersey. Location, northern New Jersey. W-2684.

TEACHING PERSONNEL FOR DEPARTMENT OF CIVIL ENGINEERING. (*a*) Professor-Department Head. Department majors in structures, both steel and concrete, and soil mechanics. Usual basic courses are offered. (*b*) Instructors to teach—principally drawing, surveying, mechanics, strength of materials, materials laboratory. Positions available September 1956. Location, South. W-2717.

EDITOR, civil graduate, for national construction magazine. Prefer someone who has had about 1½ years' experience and with ability in clear concise writing. Salary open. Location, New York, N.Y. W-2720.

STRUCTURAL DESIGNER experienced in large central station power plant or heave construction. Graduate civil or structural engineer; 10 to 15 years' experience; registration as civil or structural engineer in the State of California desirable but not necessary. Must be capable of directing activities of structural designers and detailers. Salary, $10,000–$12,000 a year. Location, Midwest. W-2753.

(*Continued on page 108*)

Civil Engineer

Have you 15 or more years of broad experience? Does it include the engineering of water supply and drainage systems, and waterfront facilities?

If so, you may be the man to fill a responsible position in the Civil Engineering Department of C F Braun & Co. The Company's modern engineering center is in Alhambra, near Los Angeles.

Your inquiry will receive prompt and confidential attention. Please write to

Mr. Rodman A Frank
C F BRAUN & CO
Alhambra, California

SOUTH DAKOTA DEPARTMENT OF HIGHWAYS

announces openings

Openings on the South Dakota Department of Highways staff present permanent opportunities for recent Civil Engineering graduates and experienced engineers in the following classifications and salary brackets:

Structural Designer $6240–7020

Structural Draftsman $5420–6240

Civil Engineers (Highway-Survey-Design-Construction) $4800–7020

These openings offer sick leave with pay, paid vacations, military leave with pay, available hospitalization plan.

Write to: **H. A. Tunge, Personnel Director, Department of Highways, Pierre, South Dakota.** Application forms will be forwarded by return mail.

AIRCRAFT ENGINEERS
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LAYOUT DESIGNERS
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Recent Graduates with Aeronautical, Mechanical, Civil or Engineering Physics Degrees may qualify.

Proof of U. S. Citizenship Required
APPLY IN PERSON
OR SEND RESUME TO:
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INTERVIEWS AT
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South Oyster Bay Road
North of Railroad
Monday thru Friday
8:30–11:30 AM; 1:30–3:30 PM

GRUMMAN AIRCRAFT
Engineering Corp.
Bethpage, N. Y.

Men and Jobs Available

(*Continued from page 107*)

ENGINEERS for the design and supervision of construction on major hydroelectric projects. (*a*) Assistant and Project Managers to take charge of the project construction. (*b*) Construction Superintendents and Assistants for field engineering, inspection, etc. (*c*) Electrical, Mechanical and Civil Engineers to take charge of electrical, mechanical inspection, and inspection of foundations and concrete. Applicants should have had extensive experience on the construction of hydroelectric plants. Location, United States and abroad. W-2768.

FIELD ENGINEER, graduate civil, about 30, for close supervision and inspection work on construction projects and to do design engineering and drafting. A number of years' experience in each is preferable. Work consists of minor industrial building and apparatus foundation and support design, both new and for alterations, and the scheduling, coordination and overall inspection of the work of contractors doing such work. Salary open. Location, New York Metropolitan Area. W-2781.

ENGINEERS. (*a*) Structural Engineer, 35-40, with 7 to 10 years' experience in structural steel and concrete design for industrial plants; to supervise structural group in construction and design department, designing structures, etc. (*b*) Structural Designer, 25–35, with at least 5 years' experience in structural steel and concrete design for industrial plants. Must be willing to work at drafting board in the construction and design department when required. Salaries: (*a*) to $9,000 a year; (*b*, *c*) to $6,500 a year. Location, upstate New York. W-2783.

RESEARCH ASSISTANTS, full- or part-time employment, on projects in mechanics with emphasis on elasticity, vibrations, and electrical instrumentation. Experience in applied mathematics or electro-mechanics desired. Opportunity for graduate study commensurate with research duties available in engineering mechanics, civil engineering, mechanical engineering, and applied mathematics. Salary, to $6,000 for full time for ten months employment. Location, South. W-2848.

INSTRUCTORS for department of civil engineering. Rank and salary will depend on experience. Location, Midwest. W-2920.

OFFICE AND FIELD ENGINEERING ASSISTANT with engineering training and surveying experience, to assist in field surveys, analysis of boring, estimates and preparation of job drawings for dredging contractor. Domestic and foreign jobs. Salary open, Headquarters, New York, N.Y. W-2926.

CIVIL ENGINEERS, senior and junior, graduates, for established public utility supervisory consulting organization; Senior, minimum of 7 years' experience; Junior, minimum of 3 years' experience; for work in connection with design of hydro systems; also structural and foundations for steam, hydro, and diesel plants. Some travel. Headquarters, New York, N.Y. W-2930.

FIELD ENGINEER, young, with civil engineering training and construction experience covering roads, buildings, swimming pools and golf courses. Location, Puerto Rico. F-2937.

INSTRUCTOR OR ASSISTANT PROFESSOR, graduate civil engineer, to specialize in structures. Salary, $4,000–$5,500 for nine-month period. Location, New England. W-2941(*a*).

SOILS ENGINEER, graduate, with experience in the testing and control of placement of soils, concrete, and asphalt mixtures for work immediately, abroad and in New England. Salary, $5,000–$10,000 a year. W-2950.

TEACHING PERSONNEL FOR DEPARTMENT OF CIVIL ENGINEERING, rank depending on qualifications. Prefer M.S. degree. Will teach courses in mechanics and civil engineering with exception of structural theory and design. Salaries open. Location, New York State. W-2960.

PROJECT ENGINEER for the design and construction of a hydroelectric plant in West Pakistan. Salary, $15,000 a year plus $3,000 living allowance. F-2980.

ENGINEER to supervise Quality Control Laboratory, civil or mechanical, to 35; recent graduate or better. Knowledge of statistical quality control. Will be trained to supervise quality control laboratory handling testing of physical properties of raw materials, products and new products. Improve quality and test methods. Company manufactures paper. Salary, $6,000–$8,000 a year. Employer might negotiate fee. Location, Midwest, C-4441.

RESEARCH ENGINEER, Structures, civil graduate, with some laboratory testing experience.

STRUCTURAL DESIGNERS

Structural Designers who want greater opportunities and diversified experience are needed by a large progressive engineering company which has served industry for more than half a century.

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HIGHWAY ENGINEER

Well established Midwestern consulting firm requires services of an experienced highway engineer to head up extensive highway design projects. Man between 30 and 45 years of age who has had experience as Chief Road Design Engineer with a State Highway Department, or man with comparable position with private firm, is preferred. Starting income of $10,000 with excellent opportunity for advancement. Applicants must be thoroughly grounded in highway design techniques, be able to perform contact work with clients, and direct large force of designers and draftsmen on diverse highway projects. Give age, education, experience and earliest date available. Replies will be held in strict confidence.

BOX 266
CIVIL ENGINEERING
33 West 39th Street
New York 18, N. Y.

At the core of work is conception, invention, design, investigation and field erection of clay, brick and tile building assemblage. For example, prestressed clay tile interior partition panels are being developed, individual or lightweight clay units leading to mortarless thin shell assemblages appear practical as result of recent clay processing invention. Laboratory investigations include analytical analysis as well as experimental work on specimens ranging to full size. Direct supervision of laboratory technicians and equipment is required to execute above work. Could lead to full responsibility for experimental structures research of original. Must be draft exempt. Salary, to $6,000 a year. Employer will negotiate fee. Location, Fox River Valley, Ill. C-4495.

FIELD ENGINEER, graduate civil or architect, about 25, with a least 4 years' experience in research, structural design, or construction operations. Duties will include field engineering involving considerable traveling contacting architects, engineers, contractors, etc., for building products association. Salary, to $6,600 a year. Location, Midwest. C-4513.

RESEARCH ENGINEER, graduate civil or architect, about 25, with at least 4 years' experience in research in structural design on construction operations. Duties will include work as research engineer for masonry building products association. Some travel. Salary, to $6,600 a year. Employer will pay fee. Location, Midwest. C-4514.

Applications for Admission to ASCE, Jan. 14–Feb. 4, 1956

Applying for Member

CALLIS HARVY ATKINS, Washington, D.C.
RICHARD SAMUEL BENNETT, San Francisco, Calif.
DONALD EPHRAIM BONJOUR, Kansas City, Mo.
HAROLD EVERETT BRADFORD, Kansas City, Mo.
HENRY DAVID BUTTERWORTH, Kowloon, Hong Kong.
JOHN GODFREY CARLTON, Buffalo, N.Y.
JOHN CARNEY, Oklahoma City, Okla.
EDWARD WILLIAM CHADEAYNE, Cleveland, Ohio.
CECIL CHAMIER DAVIS, Elgin, Ill.
FREDERIC GEORGE FULKERSON, Topeka, Kan.
VALTER HUGO FURUSKOG, Stockholm, Sweden.
GEORGE MCDUFFIE INGRAM, Decatur, Ga.
LEWIS ZIRKLE JOHNSTON, JR., Farmville, Va.
JAMES JOSEPH KENNEY, Boston, Mass.
ALLEN SISSON KOCH, Santa Ana, Calif.
NAPOLEON KORZON, Ossining, N.Y.
THEODORE ALFRED KREHBIEL, Kenmore, N.Y.
JOSEPH ROBERT LANE, Atlanta, Ga.
WILLIAM RICHARD LINSENMAIER, Pittsburgh, Pa.
PAUL WILMER MACK, Indiana, Pa.
GEORGE REEVES MCCAULLEY, Wilmington, Del.
THOMAS ANDERTON MONK, JR., York, Pa.
JOHN RUSSELL MONTAGUE, Toronto, Ont. Canada.
ROBERT DENNISTON NEIL, Pittsburgh, Pa.
ANGUS NOLAN, Concord, New Hampshire.
JULIUS ANTHONY ORAVETZ, Fort Sheridan, Ill.
LAWRENCE ALFRED PALMER, Chevy Chase, Md.
ARTHUR LEE PIEPMEIER, Oelwein, Iowa.
FRANCIS XAVIER PURCELL, JR., Mineral Wells, Tex.
MOHAMMED ALI RAHHAL, Baghdad, Iraq.
ATLEE STRICKLER RICHARDSON, Richmond, Va.
GEORGE LYNE RILEY, Frankfort, Ky.
WILLIAM FRANKLIN ROPP, Los Angeles, Calif.
MARSHAL ROBERT SANGUINET, Ankara, Turkey.
GLENN MARCUS SCHLEGEL, Los Angeles, Calif.
ROBERT EVANS SMITH, Dillsburg, Pa.
WILLIAM BRUCE SPANGLER, Vicksburg, Miss.
ELWOOD KEMPTON WILKINS, New York, N.Y.

Applying for Associate Member

ERNESTO AGUILERA, Colombia, S. A.
WALLACE HOWARD AMES, Vallejo, Calif.
GUILLERMO ANDREVE, Panama City, Panama
CHESTER HUGH BAKER, Rolla, Mo.
GEORGE EDWIN BELL, San Francisco, Calif.
TYAGARAJA BHASKARAN, Madras, India.
REINARD W. BRANDLEY, Sacramento, Calif.
ROBERT BURNS BREWER, Owosso, Mich.
ERNEST RAYMOND BRIGGS, JR., Wilmington, Del
ARTHUR COLUM BRUCE, London, Ont., Canada.
ALEXANDER T. CHOKHINE, Los Angeles, Calif.
JOSEPH D'ANGELO, Boston, Mass.
DAVID ALLEN DAY, Urbana, Ill.
DANIEL DIBONA, Philadelphia, Pa.
DONALD GEORGE DONEGAN, Houston, Tex.
GEORGE HARLAN DYE, La Mesa, Calif.
MICHAEL ANGELO FANELLI, Independence, Ohio.
LIGOR GREGORY FENERLI, Ann Arbor, Mich.
BERNARD JAMES FREDERICK, Nassau, N.Y.
PAUL KENNETH GARBER, Kansas City, Mo.

(*Continued on page 110*)

structures

STRESS ENGINEERS · STRUCTURES ENGINEERS · WEIGHT ENGINEERS · LOADS ENGINEERS · DYNAMICS ENGINEERS · FLUTTER ENGINEERS · COMPUTER SPECIALISTS · MECHANICAL ENGINEERS · CIVIL ENGINEERS

Expansion within Northrop Aircraft's Structures Department is creating an urgent demand for qualified personnel in all phases of guided missile, piloted aircraft, and equipment development. Included among the most critical job openings are positions for:

Stress Department—Mechanical or Civil Engineers to design missile ground handling equipment. An opportunity for men without aircraft experience to take advantage of the aircraft pay scale.

Structures Research—Creative engineers for three vital phases of Structural Research and Development: Thermo-Structural Analysis, High Speed Computing Technique Development and Structural Materials Research.

Weight Engineering—Junior Weight Engineers for diversified phases of missile and aircraft projects. Excellent opportunities for advancement in a relatively small department.

Dynamics—Experienced flutter engineers required for work on a variety of dynamics problems including flutter models, analytical work involving electronic computers, and methods development.

Loads—Exciting and diversified assignments in the fields of both piloted and pilotless aircraft are now available in Structural Loads Group for engineers of all experience levels.

Stress Department—Experienced Structural Engineers for positions on Long Range Interceptor Project and on advanced missile designs.

A wide diversification of assignments within each field of specialization awaits the men capable of filling the above assignments. Responsibilities will include work on many phases of missile and aircraft design, guidance systems and boundary layer research.

If you qualify for any of these challenging opportunities, we invite you to contact Manager of Engineering Industrial Relations, Northrop Aircraft, Inc., Hawthorne, California, or call ORegon 8-9111, Extension 1893.

NORTHROP AIRCRAFT, INC.

PIONEERS IN ALL WEATHER AND PILOTLESS FLIGHT

Barber-Greene
has opportunities for
ENGINEERS

Openings include design, development, field engineering and sales opportunities in conveying, ditching, and asphalt equipment fields.

Opportunities for both experienced and inexperienced mechanical and civil engineering graduates.

Training program available to supplement technical background and experience.

Barber-Greene is one of the oustanding growth companies, which offers life-time careers to outstanding men.

Submit resume outlining background, salary desired, etc., to: Personnel Manager

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AURORA, ILLINOIS

ENGINEERING OPPORTUNITIES

For highway engineers and young graduate Civil Engineers interested in future as highway design engineers. Training under competent highway specialists in expanding well-established firm.

Two or more years highway experience preferred but not required.

Excellent starting salaries, moving allowance, Blue Cross, paid vacations and holidays, sick leave, voluntary employee benefit and retirement plan.

Write for application form

SVERDRUP & PARCEL ENGINEERING CO.

1134 Locust St. St. Louis 1, Mo.

Applications for Admission

(*Continued from page 109*)

ROBERT JAMES GENEREUX, Sask, Canada
WILLIAM GEORGE GERRY, Alberta, Canada.
JAMES MAXEY GOLDSON, Corpus Christi, Tex.
MARVIN LEROY GRANSTROM, Chapel Hill, N. C.
JOHN ADAMS GREENE, Pacoima, Calif.
JOHN HARRY GRIER, Gloucester, N. J.
HARVEY GEORGE HEWITT, San Francisco, Calif.
RAY HARRISON HILL, Sacramento, Calif.
ROBERT ASHLEY HIRSHFIELD, Chicago, Ill.
ALBERT LYNN HOAG, Seattle, Wash.
IRVING ROBERT HORTON, Los Angeles, Calif.
IRVIN CARROLL HUGHES, Baltimore, Md.
JAMES MARK IOCCA, Jackson, Mich.
SAMUEL ISAMU IWATA, Newark, N. J.
KJELL OTTAR JARTUN, Tacoma, Wash.
FRANKLIN BEAUMONT JOHNSON, Austin, Tex.
MARTIN KAHEL, New Haven, Conn.
PAUL JACOB KAHN, Chicago, Ill.
FRED MASASHI KAWAKAMI, Arvado, Colo.
GEORGE ANDREW KENNEDY, Chicago, Ill.
HAI-CHANG BENJAMIN KOO, New York, N. Y.
RAJ KUMAR, Uttar Pardesh, India
CHARLES HOLWAY LAWRANCE, Los Angeles, Calif.
ROGER RILEY LINDHOLM, Sacramento, Calif.
VERNON FRANCIS MALLEY, Monterey Park, Calif.
RAFAEL MARTINEZ-ALFONSO, Rio Piedras, Puerto Rico
NEWTON LEROY MINER, River Edge, N. J.
HUGH MOORE, JR., Easton, Pa.
JOHN WALLACE NEAVE, New York, N. Y.
HARRY NELSON, JR., Minneapolis, Minn.
HERBERT CHARLES NIKOLA, New York, N. Y.
YOSHIO NOHARA, Honolulu, T. H.
JOHN CARLTON OEHMANN, Washington, D. C.
MARCUS LIAM O'SULLIVAN, New York, N. Y.
ROBERT HOWARD PEARSON, Oreland, Pa.
GLENN HARRISON PHILLIPS, Dallas, Tex.
LOUIS JAMES PIGNATARO, Brooklyn, N. Y.
JAMES OWEN POWER, Miami, Fla.
MYRON SHERMAN RAUDEBAUGH, JR., Canton, Ohio.
JOHN JAMES REEVE, JR., Albany, Ga.
JOHN HENRY RHODES, London, England
ELDOR MONROE RIEWE, Dallas, Tex.
JOHN ANTHONY ROLLER, Tacoma, Wash.
ROBERT CLAY SALE, Kenilworth, Ill.
ALFRED HARDING SETTLEMYER, JR., Yakima, Wash.
SIDNEY JACK SHERMAN, South Bend, Ind.
MELVIN SHORE, Sacremento, Calif.
WILLIAM GASTON SMALL, Independence, Mo.
HUGH MORRILL SMITH, Oklahoma City, Okla.
GEORGE FITZGERALD SMOOT, Palmer, Alaska
IRWIN SPEYER, New York, N. Y.
FREDERICK EDWIN STEACY, Syosset, N. Y.
ELWOOD WADE STEINACKER, Baltimore, Md.
ARNOLD JEROME TYER, Little Rock, Ark.
JOHN UMSTEAD, Greensburg, Pa.
SIVAN FERNANDO VAN DERDYS, San Juan, P. R.
DONALD ANTHONY WALSH, New York, N. Y.
WILBUR LEWIS WARREN, Medford, Ore.
EDWIN ADAMS WELLS, JR., San Francisco, Calif.
STEPHEN EUGENE WESSLEY, JR., Montrose, N. Y.
NORMAN ANDREW WHITE, Palos Heights, Ill.
WARREN REUBEN WIELAND, St. Louis, Mo.
FRANK HARRY WILLIAMS, Cincinnati, Ohio.
JOSEPH BINGHAM WITTY, Jackson, Miss.
KENNETH GILBERT WOLFE, Piedmont, Calif.
DOMINIC ALOYSIUS ZARRELLA, New York, N. Y.
ROY JOHN ZIMMERMAN, San Jose, Calif.

Applying for Junior Member

ARTHUR GRANT ALBERTSON, Sierre Madre, Calif.
THOMAS JOSEPH BUCHANAN, Albany, N. Y.
RAGNAR ALEXANDER CARLSON, Portland, Ore.
ANTHONY S. CASERTA, New York, N. Y.
EDWARD ARTHUR ELEVATORSKI, Harrisburg, Pa.
JORGE ERNESTO ERDMENGER, Columbus, Ohio.
ROBERT WILLIAM FLOYD, San Diego, Calif.
PAUL NORMAN FRASTER, Yuma, Ariz.
THOMAS JOSEPH GLYNN, New York, N. Y.
NICHOLAS MARTINEZ HERNANDEZ, Chicago, Ill.
ROGER JOHN HNAT, Baltimore, Md.
ROY THOMAS HORVATH, Dayton, Ohio.
JORGE HERNANDO HOYOS G., Denver, Colo.
WILLIAM HENRY LANE, JR., New York, N. Y.
EUGENE JOSEPH LESSIEU, New York, N. Y.
TING KUI LEUNG, London, England.
JIA DING LIN, Urbana, Ill.
HOWARD JOSEPH LOBB, JR., Kansas City, Mo.
LYTLE GENE MILLER, Champaign, Ill.
PETER LEONARD MONKMEYER, Ithaca, N. Y.
JAMES WILLIAM NICOLAY, Baltimore, Md.
NICHOLAS WORTHINGTON PHILIP, New York, N. Y.
THOMAS MICHAEL PICKFORD, Topeka, Kans.
ROBERT ERNEST RATCLIFF, Omaha, Nebr.
JOHN STANLEY ROZEK, Knoxville, Tenn.
LEONARD IRVING SCHIFFMAN, New York, N. Y.
JAMES ELTON SCHROEDER, Pt. Hueneme, Calif.
RICHARD CLYDE THOMAS, Cleveland, Ohio.
GERALD HENRY TOEBES, Cambridge, Mass.
KAI SUM TSO, London, England.
NNODI ANSON UGWUANYA, New York, N. Y.
ROBERT DANIEL VANDERLYN, Baltimore, Md.
DONALD CLARENCE WALTER, Tacoma, Wash.
CHARLES COLE WRIGHT, Augusta, Me.
ROBERT EUGENE WRIGHT, Sacramento, Calif.

[Applications for Junior Membership from ASCE Student Chapters are not listed.]

CONSTRUCTION LABOR ESTIMATOR

Highly responsible staff position, in headquarters of a company recognized world-wide for its achievements in chemical plant construction, for a graduate engineer with a thorough background in construction cost estimating and particularly well versed in the preparation of labor predictions for the erection of concrete, piping, insulation and instrumentation. He should also be experienced in the analysis of labor costs.

This is a challenging opportunity for the man who is seeking future growth and professional development. Please submit details of experience and salary desired. Replies held in confidence.

BOX 268

CIVIL ENGINEERING
33 W. 39th St. New York 18, N. Y.

CONSTRUCTION DEVELOPMENT ENGINEER

An experienced and ingenious construction engineer, dedicated to the principle that labor productivity can be improved through the development of special tools, jigs and fixtures, will find in this opening an excellent opportunity with a leader in the construction of petroleum and chemical plants throughout the world. It is an unusually opportune home office assignment involving ample contacts in the field. All inquiries in confidence. Please send complete resume of experience and salary desired.

Box 267
Civil Engineering
33 W. 39th St.
New York 18, N. Y.

Boeing engineers find rewarding jobs in Wichita, Seattle

This model of a supersonic airplane design was dropped at extreme altitude from a B-47 Stratojet. Telemetered data revealed the characteristics of its supersonic flight to destruction at the earth's surface. This is just one example of Boeing-Wichita's continuing development of advanced aircraft and associated system components.

At Wichita research and development programs are expanding rapidly. Laboratory space has been quadrupled and many other new engineering facilities have been added to keep pace with increasing emphasis on technical development. At both of the company's plants, Seattle and Wichita, the increased scope and magnitude of this development effort is creating additional and excellent career opportunities for civil engineers.

This means there is a real challenge for you in one of Boeing's design, research or production engineering programs. Among the interesting assignments for civil engineers at Boeing are thermo and fluid dynamics, stress analysis, structural design, and the design of tools and fixtures. You would work in a tight-knit team where there is plenty of room for self-expression and recognition.

Boeing engineers are working now on future airplanes and missiles that will maintain the standard of technical superiority established by the B-47 medium bomber, the B-52 intercontinental bomber, the BOMARC IM-99 pilotless interceptor, the 707 jet transport and the KC-135 jet tanker-transport.

Recognition of professional growth is coupled with career stability at Boeing — twice as many engineers are now employed by the company as at the peak of World War II. They enjoy a most liberal retirement plan. How would *you* like a satisfying, creative job with the pick of the engineering profession? There may be one waiting for you in the progressive communities of Wichita or Seattle.

R. J. B. HOFFMAN, Administrative Engineer
Boeing Airplane Co., Dept. D-49, Wichita, Kansas

JOHN C. SANDERS, Staff Engineer — Personnel
Boeing Airplane Co., Dept. D-49, Seattle 14, Wash.

If you want further information on the advantages of a career with Boeing, please send coupon to either of the above addresses.

Name_____

College(s)_____ Degree(s)____ Year(s)____

Address_____

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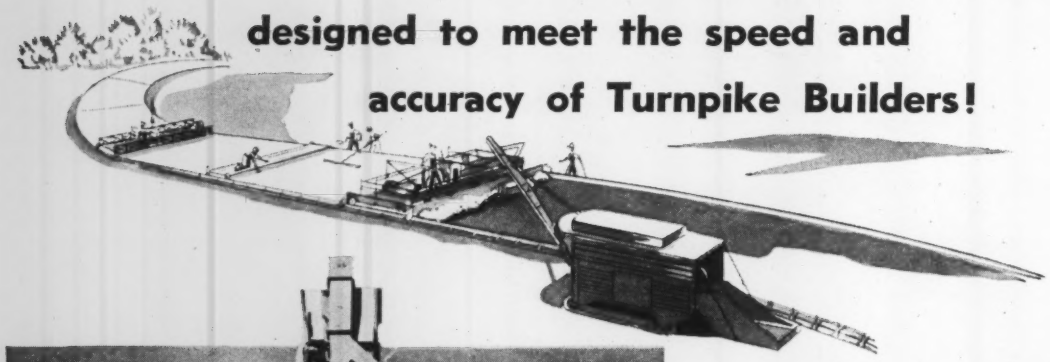
BOEING

Aviation leadership since 1916

SEATTLE, WASHINGTON WICHITA, KANSAS

Strictly for Production

New Heltzel Batchmaster Plants designed to meet the speed and accuracy of Turnpike Builders!

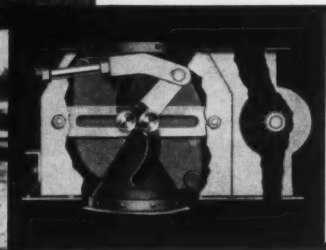


HERE are the paving plants the industry has been looking for! Big capacity Heltzel Batchmaster Production Paving Plants that have the portability, speed and accuracy to more than meet modern day work schedules and job specifications.

Let's look at the Standard E-3 Automatic Cement Batchmaster. Of flare leg design, to permit easier truck access, the plant has the exclusive Heltzel combination gravity vane cement charger (below) that means the fastest, most accurate batching yet possible. Designed for fast, easy dismantling, it easily comes within the dimension limitations for over-the-road hauling. The plant itself will hold up to 609 bbls. of cement. Add Heltzel's high speed recirculatory system and this capacity can be expanded to over 1600 bbls. Smaller size recirculators also available.

A perfect mate to the E-3 is the Type 200 Batchmaster aggregate plant. It is a sturdily built, portable plant that holds a full 200 tons. Yet it can be quickly dismantled into four sections for transporting from one location to another. It is compartmented to suit requirements. It will carry the largest batchers made, including Heltzel's exciting new electronic unit.

If your program for this year calls for the placement of a large quantity of concrete, these plants will save their initial cost in short order. Before you buy equipment, let us show you their many advantages. And remember, it costs no more to own Heltzel Batchmasters—so why not operate with the finest.



The amazing Heltzel Combination Gravity Vane Cement Charger that permits cement batching with a speed never before attained, to an accuracy that has rewritten the record books. It's standard equipment on all automatic Batchmaster plants.

THE HELTZEL

Paving!

9897

HELTZEL

BATCHING PLANTS

Heltzel is one of the nation's leading proponents of automatic and electronic batching. Let their sales engineers show you the latest in these modern day batching techniques.

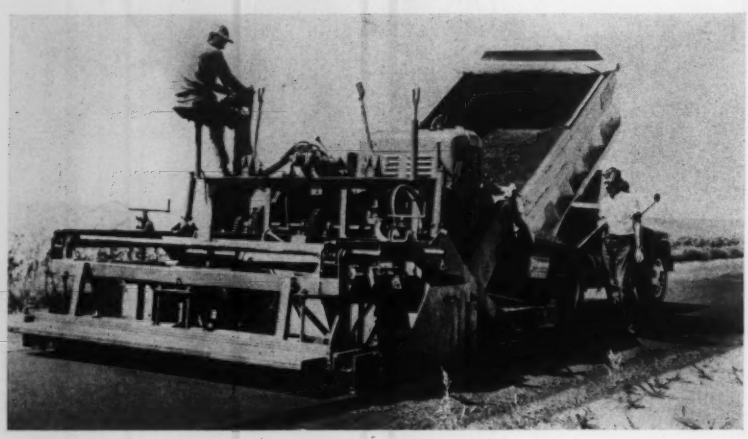
STEEL FORM AND IRON COMPANY

71000 THOMAS ROAD

WARREN, OHIO

EQUIPMENT, MATERIALS and METHODS

NEW DEVELOPMENTS OF INTEREST AS REPORTED BY MANUFACTURERS



Bituminous Paver

NAMED THE VIBROMATIC and described as "the paver of the future," a new paver is specifically designed to give controlled compaction and uniform density of mat at a laydown rate exceeding previous standards. Key units of the new paver are the screed and compactor. The oscillating screed meters out the material as required for whatever thickness of mat is needed, and by means of oscillation and vibration, fills in the voids across the entire width of the mat being laid. Following the screed is a high-speed vibrating compactor, heated across its full width, which irons out the surface of the mat to a uniform density.

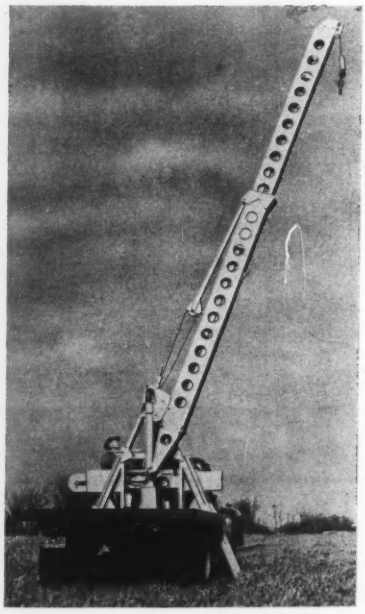
With traveling speeds up to 2.64-mph forward and 1.14-mph reverse, the paver can lay between 250 and 300 tons per hour, moving at top paving speed. Unobstructed direct visibility of all phases of the paving operation is another feature of the paver. Dimensions of the Vibromatic include a length of 18-ft, and a 10-ft width, without moldboard and beveling attachments which can be supplied. **Pioneer Engineering Works, Inc., CE 3-114, 1515 Central Ave., Minneapolis, 13, Minn.**

Earth Drill

LARGER AND MORE RUGGED THAN PREVIOUS MODELS, is a new model 200-A bucket-type earthdrill which will bore 16 to 84-in. holes to a depth of 200-ft. On each pass it will remove 37.5-cu ft of earth, thus accelerating such earth boring jobs as required in heavy construction, mining and oil field work. Drilling, hoisting and dumping are performed mechanically, with all controls centrally located in a single unit for one-man control. The bucket is unloaded by a simple hand-tripping arrangement. With a wide variety of interchangeable bucket-drill accessories, boring in every type of soil is possible. Model 200-A is adaptable for boring caisson pier holes, pre-boring concrete piles, drilling wells and cesspools, exploring mineral deposits, and testing soil conditions. **Caldwell, Inc., CE 3-114, 7222 E. Slauson Ave., Los Angeles, Calif.**

Telescopic Boom

A BOOM THAT WILL TELESCOPE hydraulically with a full-capacity load is one of the many improvements in the new model 60 Hydra-Lift now being introduced.



Model 160 Hydra-Lift

Lift Truck Accessories

MAXIMUM SPEED AND EFFICIENCY in the handling of all types of open-center loads is assured by employing the combined utility provided by two lift truck attachments, the unloader and the ram attachment. The ram is a horizontal, pole-like device suspended from the fork support bar of the lift truck, the design of which facilitates its entry and withdrawal from open-center loads. It is controlled by the standard lifting and tilting mechanism of the lift truck, and can pick up or deposit materials at any height within the lifting range of the particular model to which it is attached.

The unloader, a compact mechanical pusher, eliminates the need for any manual handling. It is controlled by a lever at the operator's fingertips, which pushes the load from the ram, using smooth, hydraulic action. **Towmotor Corporation, CE 3-114, 1226 East 152 St., Cleveland 10, Ohio.**

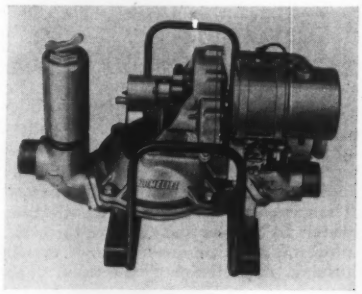
Radio Transceiver

RETAINING MANY OF THE FEATURES of the more expensive "Walkie-Talkie" type equipment, a new 2-way Radio Transceiver is a simplified radio communication unit at a price anyone can afford. It operates over the Citizens Radio Band reserved by the FCC for short distance personal radio communication. The transceiver sends and receives clearly for over ten miles when units are in line of sight, and operates successfully at $\frac{1}{2}$-mile through most obstructions. Light in weight, it plugs into any 115-V AC outlet or 6-V DC supply. Operation is simple consisting of a short warming up period, pushing a button, then talking into the handsized mike. The message is clearly received over the loudspeaker contained in the unit. The transceiver should be of great assistance in all sorts of engineering and construction work, as it requires no tuning or special tools or apparatus. **Vocaline Company of America, Inc., CE 3-114, Old Saybrook, Conn.**

Capable of being installed on any truck two tons or larger, the Hydra-Lift retains all the desirable features of the former Model-B. With the hydraulic boom which telescopes from 17 to 27-ft, loads can be positioned in spots which it would be virtually impossible to reach with a standard type boom. Other improvements are hydraulically-operated outriggers, the replacement of hydraulic hosing with seamless steel tubing, the reduction of installation time, and package unit shipping. In addition, full-capacity loads can be lowered or raised with the boom. **Pitman Manufacturing Company, CE 3-114, 115, 300 West 79th Terrace, Kansas City, Mo.**

Diaphragm Pump

ALL HEAVY-DUTY PUMPING is easily handled with a new diaphragm pump. With a pumping capacity of 5000-gal per hour, the Model 20DP3 solves many of the dewatering problems of contractors,



Model 20DP3

builders, construction men and utility companies. Weighing only 120-lb, its simple compact design makes it possible to set up pumping operations quickly in any location. Economical to operate, the 20DP3 will run 6-hr at full capacity pumping on 1-gal of fuel.

The throttle on the float-type carburetor can be hand-regulated to adjust engine speed for different pumping conditions. Completely self-priming, the 20DP3 will dry-prime up to 15-ft in 15 seconds. This diaphragm pump has a guaranteed suction lift of 28-ft, and a total head of 50-ft, including friction. **Homelite, CE 3-115, 75 Riverdale Ave., Port Chester, N. Y.**

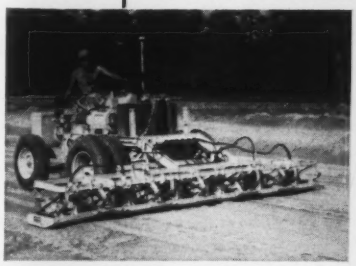
Motor Grader Attachments

A NEW SET OF HYDRAULIC ATTACHMENTS for the No. 12 and No. 112 Motor Graders is announced. They include a hydraulically shiftable moldboard, snow plow and bulldozer mounting and a hy-

Here's TREMENDOUS COMPACTION

. . . for rapidly and most economically achieving or exceeding specified densities in the consolidation of rock, slag, gravel and sand base courses in waterbound and penetration macadam construction. The Jackson does it in just about half the time required with equipment of other types and is equally efficient in filling all the voids from top to bottom of rock and slag courses when sufficient fines have been spread.

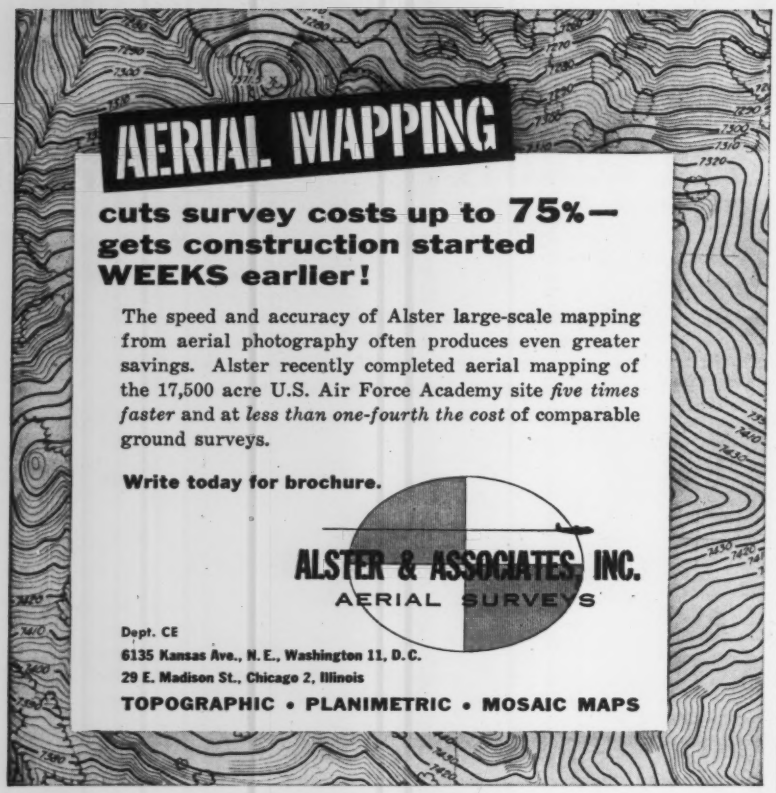
Exceptional ON-THE-JOB ADAPTABILITY!



Above: a Jackson Multiple (6 units) on 7 mile sub-grade. Below: 2 units equipped with operating handle, self-propelling and easily operated by one man.

Standard width of the Jackson Multiple is 13', 3"; working speeds: up to 60' per minute; reverse: up to 5 MPH. Working width can readily be altered on the job to exactly suit narrower requirements such as widening projects. As many of the 6 compacting units as desired can be subtracted from the workhead, quickly and easily. Furthermore, easily interchangeable bases from 12" to 26" are available and individual compacting units may be fitted with operating handles and used exactly like the standard, highly popular, self-propelling manually guided Jackson Compactor. As a consequence Jackson equipment can be used on a great deal of work other machines cannot reach. If you have any job requiring compaction of granular soil, it will pay you to know specifically what Jackson Vibratory equipment will do. See your Jackson distributor. Literature and name of nearest Distributor on request.

JACKSON
VIBRATORS, INC.
LUDINGTON, MICH.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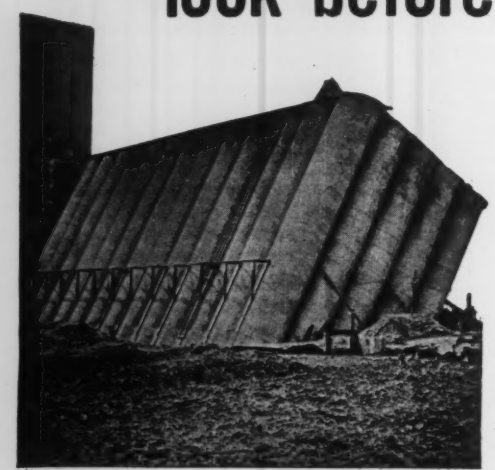

Transcona Elevator, Canadian Pacific Railway, Winnepeg, Canada, which tipped 27°—righted by the Foundation Company Ltd. of Canada.

An elevator tips—a bridge sags—a building settles—a dam goes out—costly and serious mistakes in construction work. That's why it pays to make test borings before designing foundations. And, when you investigate subsoil conditions, you want the best—ACKER! For, Acker makes a complete line of low-cost, easy-to-operate soil sampling equipment—from hand to power driven tools.

Remember, too, Acker's 33 years of experience in designing and building soil sampling and core drilling equipment ONLY, is your guarantee of dependable, satisfactory operation.

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723 W. Lackawanna Avenue Scranton, Penna.
Manufacturers of a complete line of Diamond and Shot Core Drills, Drilling Accessories and Equipment

EQUIPMENT MATERIALS and METHODS

(continued)

draulically actuated snow wing. Power for the attachments is supplied from a new enclosed hydraulic system mounted on the front of the dashboard between the frame members. Valves, located inside the reservoir, can be stacked to allow any or all of the attachments to be used together. Controls for the attachments are conveniently located inside the cab. **Caterpillar Tractor Co., CE 3-115, 116, Peoria, Ill.**

Pneumatic Compactor

A REVOLUTIONARY DESIGN in heavy duty pneumatic tired road compactors is announced by a manufacturer of road stabilization equipment. The new compactor, self-propelled, is capable of road speeds up to 20-mph for easy transport

Self-Propelled Compactor

to the job. Equipped with power steering for effortless maneuverability, it easily makes a 180-deg turn on a 20-ft roadway. The compactor has nine pneumatic tired wheels on the rear and eight on the front, providing a straight down pressure, even in turning, that eliminates the usual pushing action, surface shear, scuffing, and material displacement of ordinary rollers. Four 5-gal compartments provide for liquid or sand ballast, for wide variation in road weight from 5-ton empty weight, to 15-tons with water or 20-tons with sand ballast. **Seaman-Andwall Corporation, CE 3-116, 291 North 25th St., Milwaukee 1, Wisc.**

Green-Yellow Slide Rule

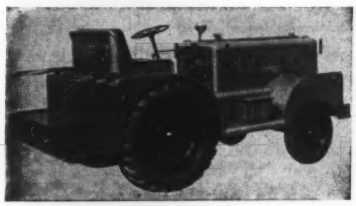
A NEW LIGHT-ALLOY SLIDE RULE, made in a shade of green-yellow, eliminates violet and red rays which focus in front of and behind the retina. The green-yellow shade coincides with optimum sight point of the spectrum, cutting eyestrain, blurring and other errors in reading calibrations. With its non-corrosive, non-rusting metal construction, it eliminates warping, swelling and binding. The slide rule is made in 6-in. and 10-in. trig, log-log standard rules, or in rules made to special order. **Pickett & Eckel, Inc., CE 3-116, 1109 South Fremont Ave., Alhambra, Calif.**

EQUIPMENT, MATERIALS and METHODS

(continued)

Weldmobile

THE WELDMOBILE is designed to provide a mobile self-propelled welding unit for installations in which welding applications occur at widely separate points. By traveling directly to the job and being ready to weld without waiting for electricians to hook up power lines, the unit saves hours of time. Since its towing



400 & 600-amp. Models

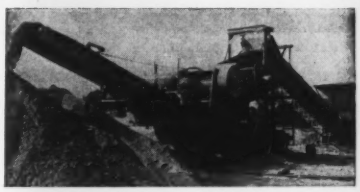
capacity is rated at 2000-lb draw-bar pull, it can tow other equipment or material to the job. The 400-amp model is powered by a Chrysler 6-cylinder industrial engine, and the 600-amp model is powered by a Chrysler V8-cylinder engine. The Weldmobile can supply up to one kilowatt (110-v DC) auxiliary power for operation of lights and electric motor powered equipment. Two wells and brackets are located at the rear for acetylene and oxygen tanks. **Hobart Brothers Co., CE 3-117, Hobart Square, Troy, Ohio.**

Truck Crane

A NEW TRUCK CRANE is a 35-ton rubber-mounted unit with exceptional performance characteristics for many different types of crane work. These include applications in crane, clamshell, dragline and steel rigging service. A few of the features of the 43-MR are dual front axles, power-removable counterweight, and 180-in. wheelbase for greater maneuverability in traffic and on the job. With full power, operational flexibility and positive air control, the machine will carry its maximum rated load, with outriggers, at a radius of 15-ft. This larger capacity machine will handle normal loads on longer booms at a greater radius, thus greatly increasing the general usefulness of the machine. **Marion Power Shovel Co., CE 3-117, Marion, Ohio.**

Mobile Crushing Plant

A NEW MOBILE CRUSHING PLANT has as its key unit the 18 by 36 roller bearing 10-ton Jaw Crusher with its one-piece electrically welded frame. Jaws can be adjusted to turn out 1 to 5-in. material. Both stationary and movable jaws are reversible for extra wear. The power source for the 60-hp motor is a mobile



generator set. Capable of 100 to 125-yd per min single pass, the plant has a push-button control panel and platform on the base frame assembly. Both feed and discharge conveyors are powered independently of crusher for more flexible operation. **Eagle Crusher Company, CE 3-117, Galion, Ohio.**

Model E 14″ Long—$7.00
with irregular curve adjusting feature — $8.50
Other Models 1′-6″ and 2′-0″ priced from $10.00 to $15.00. Ten Day's Trial. Write for complete descriptive leaflet.

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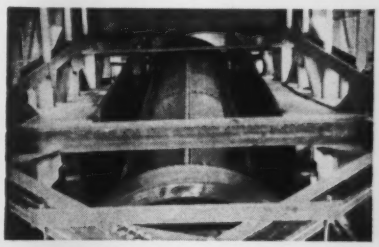
BUCKET LADDER AND HYDRAULIC DREDGES for dredging placer properties, harbor and levee construction, channel changes, production of sand and gravel. Hydraulic dredges from 6-inches up; bucket sizes: 2½ to 18 cu. ft., or larger. Digging depths below water as required.



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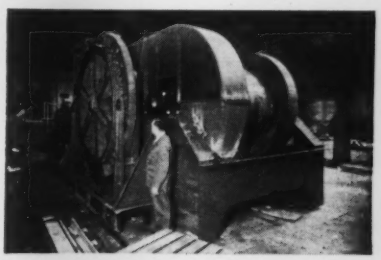

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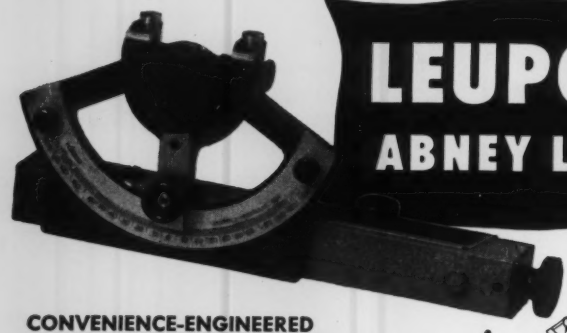
Power plant site uses seismic surveys on land and under water

In planning the site of a power plant and associated structures for New England Electric System, Rome Point, North Kingstown, R. I., the engineers (New England Power Service Co., Boston, Mass.) called in Gahagan to make a land-and-water seismic survey. Object was to profile bedrock depth on land, and also in the access channel and turning basin areas to estimate cost of dredging to 40 feet below mean low water. A total of 7,500 feet of land profiling and 25,700 feet of underwater profiling by a Gahagan Seismic Survey Crew gave the answer—in just 18 working days. Results correlated closely with 7 check borings. Get the full story on use of seismic surveys by design engineers. Write for Bulletin 2, Geophysical Survey Division, Gahagan Dredging Corporation, 90 Broad St., New York 4, N. Y.

Established in 1898, Gahagan is a leader in hydraulic dredging

ANOTHER
GAHAGAN
CASE HISTORY



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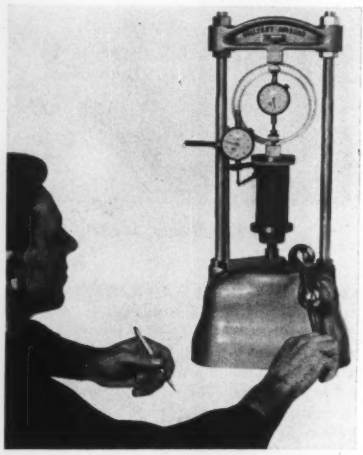
EQUIPMENT MATERIALS and METHODS

(continued)

Compression Apparatus

A NEW TYPE of hand-operated unconfined compression apparatus that can be used in making field or laboratory tests of soils has been developed. The new piece of equipment is compact, portable and



500-lb. Compressor

easy to operate. Working on a mechanical screw principle, the operation is thoroughly simplified. Loading of the specimen is accomplished by turning the operating handle at any desired rate. In this manner, the investigator can adjust his loading either to conform to the uniform rate of strain or the uniform rate of loading requirements. The load applied to the specimen is indicated on the dial of a calibrated double proving ring, while specimen strain readings can also be taken during the test. The load capacity of the apparatus is 500-lb. **Soiltest, Inc., CE 3-118, 4711 W. North Ave., Chicago 39, Ill.**

Water Conditioner

THE MARKETING OF A NEW WATER CONDITIONER that eliminates and prevents scale and corrosion formation in boilers and water systems without the use of chemicals is announced. It is the first important application of nuclear physics principles to the effective treatment of industrial water problems. For use on boilers, air conditioning and refrigerating systems, and other industrial applications where water problems exist, the conditioner prevents scale and corrosion by imparting added energy to the atoms of

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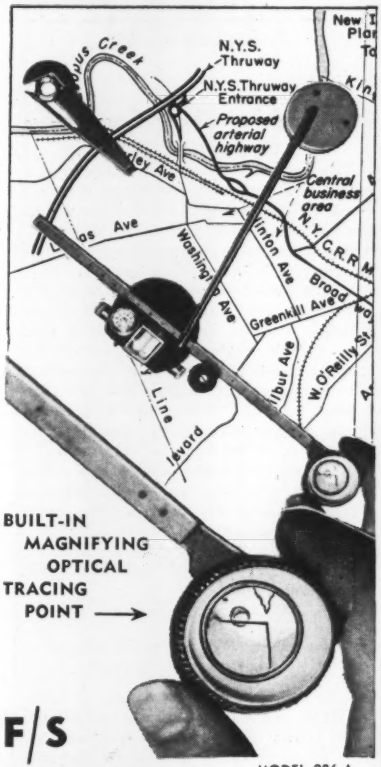

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EQUIPMENT MATERIALS and METHODS

(continued)

the water solution. The conditioner is manufactured in sizes handling from 6.5 to 1760-gal per min for connection with corresponding standard iron pipe sizes ranging from $^3/_4$ to 12-in. **Packard Water Conditioner Division, Inc., CE3-118, 119, 2220 West Beaver St., Jacksonville 9, Fla.**

Trailer Dumps

A NEW SERIES OF SINGLE AND TANDEM AXLE trailer dumps and 4-wheel trailers, with payload capacities of up to 30-cu yd, is now on the market. Equipped with front-mounted single cylinder telescopic hoists, the new units are designed for over-the-road hauling of aggregates and other bulk materials. Suitable for use with either single or tandem axle tractors, these new trailer dumps are ideal for operation in areas where weight laws establish medium to high gross weight limits and allow credit for one or more sets of tandem axles.

Lifting capacities of up to 35-tons are provided by a single 5-sleeve, 8-in. telescopic hoist, front mounted on 17 to 24-ft single and tandem axle trailer dumps. These durable, yet light weight trailer units are constructed for maximum useful service life. High strength alloy steel is used throughout the body. Standard equipment includes 7-in. air brakes, landing gear, ICC lights, directional signals and mud flaps. **Hercules Steel Products Company, CE 3-119, Galion, Ohio.**

Concrete Paving Equipment

SEVERAL NEW ADDITIONS in this company's development program, completing their line of concrete paving equipment, are now on the market. All tested and proved on the job, they include a self-widening finishing machine equipped with 16-in. wide screeds and six speed transmissions. The machine operator, by simple control, widens and narrows the width of the machine as it works concrete. This innovation in finishing machine development meets the demand for self-widening equipment brought about by increasing expressway and interchange construction.

A curb building machine mechanically finishes roll type curbs. It eliminates to a large extent the hand labor necessary to hand-form roll type curbs. The machine is designed to work in tandem with the GRM off-set screed finishing machine which eliminates carry back of concrete for integral curb construction. **General Road Machines, Inc., CE 3-119, North Main St., Niles, Ohio.**

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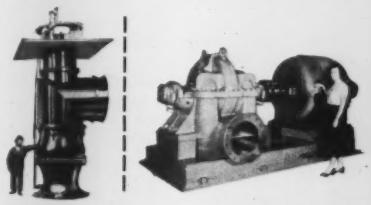

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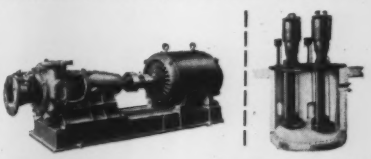

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DUPLEX, SUBMERGED NON-CLOG FOR SANITATION SEWAGE, INDUSTRIAL WASTE

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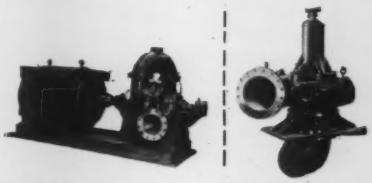

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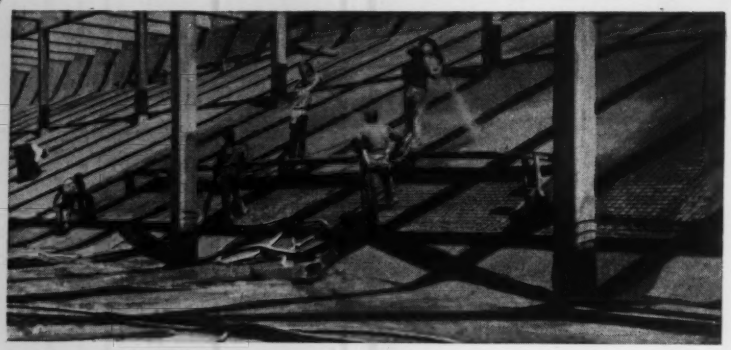

"GUNITE" Lining Restores Reservoir

When the old, open Ballou Park Reservoir at Danville, Va., was improved and covered in 1948, excessive leakage of the old brick lining was stopped with reinforced "GUNITE". The photo shows details of the process. After concrete columns to support the roof were placed, wire mesh reinforcing was laid and the entire reservoir was "GUNITED." Note that the reinforcing and "GUNITE" were carried over the column footings and up the columns approximately three feet to prevent leaking at those points.

The use of "GUNITE" for repair and construction of reservoirs, bridges, buildings, etc., is illustrated and described in Bulletin B3000. We will gladly send a copy at your request. On your letterhead, please.

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EQUIPMENT MATERIALS and METHODS

(continued)

Stud Welded Shear Connectors

THE EMERGENCE OF STUD WELDING as a major new factor in reinforced concrete construction was highlighted recently with the erection of the first composite steel and concrete bridge using end welded studs as shear connectors. The granular flux-filled studs were end welded approximately four times faster than usual. One of the principle reasons for using studs is that they permit concrete to be compacted more satisfactorily, so that interaction between the concrete slab and the steel beam is assured. The studs also permit a clean design with great flexibility in placement, as well as being convenient aids in spacing mat for the reinforcing bars. In addition, the distortion and warping caused by hand welding other types of shear connectors to bridge girders is eliminated. **Nelson Stud Welding Division, CE 3-120, Gregor Industries, Inc., Lorain, Ohio.**

Rotary Compressor

WITH THE ADDITION of a new 210 portable rotary compressor, a complete new line of modernized Blue Brute compressors, which include the 125, 315, and 600 sizes, are now available. Incorporating the same basic features and engineering advancements as the other units, the 210 compressor has a newly designed clutch, and a separate oil compressor reservoir equipped with a pre-heater. The 210 Blue Brute machine is a small size, lightweight unit with extremely high and rugged operation efficiency. **Worthington Corporation, CE 3-120, Harrison, N. J.**

Drawing Board Attachment

DESIGNED BY A PRACTICING ARCHITECT to fill a long-felt need, Spiroll is a new drawing board attachment that protects drawings, reduces fatigue, and takes the stretch out of drafting. Constructed of non-corrosive sheet steel with a gray enamel finish, Spiroll attaches easily to the front edge of any drawing board. By sliding the drawing down into the device, the bottom section of the sheet is coiled safely out of the way, and the top section can be worked on easily and comfortably. The sliding action is smooth and trouble-free because there are no moving parts to stick or jam. A unique hinged construction allows easy access to drawers under the board without disturbing work in progress. **Spiroll Products Company, CE 3-120, Room 22, 1 Concord Road, South Sudbury, Mass.**

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FILMS AVAILABLE

"THE LAST WORD IN SURVEYING INSTRUMENTS"—Projection time of a new 16-mm movie filmed in Switzerland is 29-minutes. The film begins with a short historical glance at Switzerland's period of technical and economic pioneering in the past century, then continues with a review of the progress made by Kern & Co. Ltd., in the manufacture of geodetic and optical instruments. Beginning with Kern's traditions in the creation of precision instruments and revolutionary innovations, the film gives an interesting review of the manufacture of modern surveying equipment. **Kern Instruments, Inc. CE 3-121, 120 Grand St., White Plains, N. Y.**

"THE LAST MILE"—A new and dramatic highway safety film has been released. A 20-minute presentation points out the dangers involved when construction crews begin the job of turning an old overcrowded and poorly maintained road into a safe modern highway. The movie depicts how the highway becomes doubly dangerous when construction begins, not only for the countless drivers who thread their way through the temporary construction zone but for the workers on the job as well. The film contains a message for both the motorist and the construction worker. **Caterpillar Tractor Co., CE 3-121, Peoria, Ill.**

"THE CHOICE IS YOURS"—A recently produced 15-minute sound slide film uses case histories to discuss applications and construction features of vertical wet pit pumps. The film depicts special diving bell construction which protects motors, controls and thrust bearings from flooding; the revolutionary Lubri-Vac system which increases pump life 10 to 12 times; special jacketed stuffing boxes for cooling, heating, or pressurizing on special applications; and the convenient "stay-primed" design. **Yeomans Brothers Company, CE 3-121, 1999 North Ruby St., Melrose Park, Ill.**

"THE SUBMERSIBLE STORY"—A new film on the submersible method of pumping is said to be the first complete factual story of the submersible pump's history and development as well as its construction and operation. The submersible's progress from early designs to present day applications and installations is shown. Extensive animation is used to illustrate the operation and make graphic the construction and working principles of key submersible parts, including the mechanical and mercury seals. **Byron Jackson Pumps, CE 3-121, Roger Barron, Submersible Products Manager, P. O. Box 2017, Terminal Annex, Los Angeles 54, Calif.**

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for "wall-floor" and "between-pour" horizontal concrete construction joints

Water just can't get through joints protected by FLEXTRIP, the all-new, strip-type waterstop. Unique concave shape plus ribbed edges give FLEXTRIP a never ending grip in the concrete . . . is flexible enough to withstand extreme joint-separation (more than 3 inches) yet rigid enough to stand up to the battering effect of pouring concrete. Here's lasting joint-protection unmatched by any other waterstop. What's more, FLEXTRIP will never rust, rot, check or crack and is unaffected by acid, alkalies, petroleum products, chemicals or the most adverse atmospheric conditions . . . lasts as long as the concrete. Write for additional information on FLEXTRIP and other vinyl waterstops. Send coupon below.

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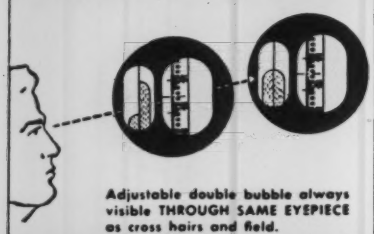

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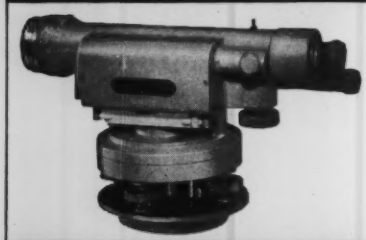

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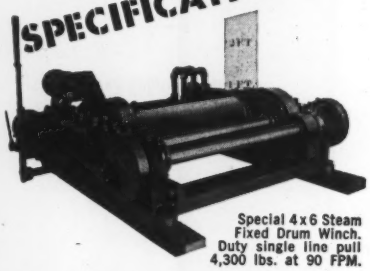
From the MANUFACTURERS

FIRST CAST IRON PIPE PLANT IN CHICAGO AREA: James B. Clow & Sons, Inc., are building a new plant in Bensenville, Ill., which will have a capacity for producing 80,000 tons of pipe per year for use primarily in municipal water and gas distribution systems . . . **CERTIFIED OPERATOR PROGRAM:** Certification of heavy construction equipment operators, a program carried on for 15 years now by LeTourneau-Westinghouse, has been broadened to include operators of Adams Motor Graders . . . **AGGREGATE PRODUCER:** Sayre & Fisher, a 106-year old brick company, has announced its entry into the revolutionary lightweight concrete aggregate field. The aggregate will be manufactured from their clay deposits in Sayreville, N. J., and will be available throughout the entire East Coast . . . **NAME CHANGE:** Gahagan Construction Corporation has officially changed its name to the Gahagan Dredging Corporation, a move made to reflect the principal activity of the organization . . . **CENTENNIAL ANNIVERSARY:** The Robinson Clay Products Company of Akron, Ohio, celebrates its 100th anniversary this year. The company is one of the nation's largest manufacturers of vitrified clay pipe . . . **ATOMS IN CALIFORNIA:** The General Electric Company is establishing headquarters in San Jose, Calif., for its Atomic Power Equipment Department now temporarily located in Schenectady, N. Y. It develops, manufactures, and markets atomic equipment for commercial peacetime uses . . . **FOREIGN SUBSIDIARY:** Infilco, Inc., manufacturers of equipment for treatment of municipal water supplies and domestic sewage, announces the formation of an Australian subsidiary with offices in Sydney. This becomes their third foreign subsidiary, the other two being located in Mexico and Canada. A fourth subsidiary is in the process of formation in Japan . . . **NEW DIVISIONS:** A Materials Handling Development Center has been opened by Clark Equipment Company in Battle Creek, Mich. Its purpose will be to analyze the handling problems of individual industries, and develop new methods . . . A new division has been formed by Union Carbide and Carbon Corporation to take over the development, manufacture and sale of products in the fast-growing field of silicones . . . **2-YEAR EXPANSION PROGRAM:** Stran-Steel Corporation's two million dollar expansion program will include a new plant which will be an all-steel building. Manufacturing space will be increased by about 20%, and will house additional fabricating facilities and automatic welding equipment . . . **ELECTIONS:** E. E. Boberg, Vice-President of Standard Conveyor Company is the new President of the Conveyor Equipment Manufacturers Association . . .

You SET THE SPECIFICATIONS...



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879. Planned Industrial Districts, by Victor Roterus. (CP) Planned industrial districts, like planned residential districts, are subdivided and developed under definite plans and controls. The paper describes the advantages of planning to industry and the neighboring residential communities, including possible economies in public utilities and other public services.

880. Design of Stable Canals and Channels in Erodible Material, by Pete W. Terrell and Whitney M. Borland. (HY) This paper covers major factors which must be integrated into the design of a canal and outlines present methods of canal design. Several methods for computing the proper size and shape of channels are suggested, and an example is presented. Practical considerations and field experience related to stability problems are cited.

881. Discussion of Proceedings Papers 489, 536, 667, 678, 716, 744, 745, 747, 791, 882. (HY) E. L. Hendricks closure to 489. V. T. Chow closure to 536. T. Blench closure to 667. F. Paderi on 678. W. D. Baines on 716. W. H. Sammons on 744. E. Kuiper, W. H. R. Nimmo on 745. A. Shukry, J. M. Robertson, E. F. Rice on 747. A. J. Peterka and J. N. Bradley on 791. H. A. Foster on 882.

882. Economic Aspects of Flood Plain Zoning, by H. W. Adams. (HY) The zoning of flood-plain lands for the alleviation of flood damages has not been extensively used as a primary means of damage prevention. The economic aspects of zoning cited in the paper make it essentially an alternative to evacuation or to prevention.

883. Evaluating Effects of Land-Use Changes on Sediment Load, by Alfred J. Cooper and Willard M. Snyder. (HY) The effects of land-use changes on the suspended sediment load characteristics of tributary watersheds are evaluated by multiple regression analysis. Time-regression functions representing the effects of changing vegetal cover and the hydrologic parameters in the models are tested for significance in adjustment of the data.

884. Methods of Determining Consumptive Use of Water in Irrigation, by R. D. Goodrich. (IR) Attention is called to early investigations of the "duty of water" in irrigation and to "consumptive use of water" or "evapo-transpiration." Standard methods of determination of rates of consumptive use are outlined, and the utilization of their results in measuring farm and valley uses is described.

885. Sanitary Engineering Programs of the I.C.A. in the N.E.A. Area, by Vincent B. Lamoureux. (SA) General sanitation problems relevant to the program of the International Cooperation Administration in the Africa, Near East, and South Africa area are described, and the problems of the individual countries are examined.

886. Industry Location Factors, by Jerome P. Pickard. (CP) Improved transportation has affected various locational factors so that there is now greater freedom of locational choice, which leads to the dispersion of industry. Locational factors are considered, and differences between industries located in suburbs and those within cities are described. An example is given.

887. Pilot Plant Composting of Municipal Garbage at San Diego, California: Progress Report of the Sanitary Engineering Research Committee, Rubbish and Garbage Section. (SA) The paper evaluates results of a pilot plant investigation of the feasibility of composting municipal garbage in which various methods of composting tried were including the use of additives and grinding.

888. Variation of Point Rainfall with Distance: Progress Report of the Sanitary Engineering Research Committee, Water Section. (SA) The variation of point rainfall with distance was studied using data from a 50-gage network within a 100-sq-mile area in central Illinois. It was found that the regression system is most practical for prediction purposes.

889. Effect of Air Conditioning on Distribution and Pumping Stations, by C. Kelsey Mathews. (SA) The effect of air conditioning on the design of water distribution systems—distinct from its effect of treatment plants—is presented. Comparative measurements indicate an excessive investment in the distribution system if nonconserved air conditioning is not prohibited.

890. Recovery of Usable Water from Saline Water, by David B. Smith and Charles E. Richheimer. (SA) Future water demands require that all sources of water be used. One potential source of water is in the vast quantities of saline water. Various methods for recovery of usable water from saline waters are discussed, and the economics of each process is developed.

891. Pollution of Los Angeles and Long Beach Harbors, by Linne C. Larson. (SA) After a factual survey and investigation of the disposal of sewage and industrial wastes in harbors, long-range waste disposal and water quality objectives were formulated and adopted for Los Angeles–Long Beach Harbors. The objectives and the results obtained are described.

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892. Planning Sewerage Services for Suburban Areas, by Ray E. Lawrence. (SA) Some of the problems of providing sewerage services for suburban areas can be avoided by careful advance planning. Joint use of trunk sewers and sewage treatment facilities by districts and municipalities should be considered. Examples of the stage development of a sewerage system on the basis of drainage area are cited.

893. Transportation Planning: The Port —A Focal Point, by Roger H. Gilman. (CP) The port has become a focal point for every form of transportation, not only by water but by land and increasingly by air. The paper points out that attention must be given to present and future trends of all forms of transportation and to integration, coordination, and cooperation among the public agencies and private interests concerned.

894. Transportation Planning: The Airport, a National Facility, Wilfred M. Post, Jr. (CP) This paper describes how a medium-size trunk-line airport has been developed, financed, and is being operated under a local airport authority. The legal and economic history of an airport is traced, including the creation of the airport authority after World War II. The operations and financing of the airport are further considered.

895. Fish Passage Facilities at McNary Dam, by Glenn H. Von Gunten, Hugh A. Smith, Jr., and Berton M. Maclean. (PO) Fish-passing facilities represent a major item in the operation and maintenance cost at McNary Dam. This paper provides a description of fish-passing facilities, a discussion of the functional design, a résumé of construction and operation problems, and a discussion of possibilities for further improvements in design.

896. Trombay Power Station: Cooling Water System, by William Wallace and George E. Archibald. (PO) Large steel pipes carrying cooling water are supported above high water in Bombay Harbor. A pipe-supporting concrete trestle has piles grouted into sockets in the rock floor of the harbor. Pipe anchorage is varied to accommodate conditions of support.

897. Water Resources and Power Studies, Task Force, Hoover Commission: Organization and Scope; Conclusions and Recommendations, by Ben Moreell. (PO) The basic organization of the task force and the scope and objectives of the studies undertaken by it are presented. The author's conclusions and recommendations, based on the contents of the final report, are offered.

898. Water Resources and Power Studies, Task Force, Hoover Commission: Power Generation and Distribution, by John Jirgal. (PO) The federal government's largest and most rapidly expanding business venture is the generation and sale of electric power. In 1933 the federal government owned less than 1% of the total utility plant capacity in the United States and by 1953, 12½%. By 1960 it will be about 16%.

899. Water Resources and Power Studies, Task Force, Hoover Commission: Reclamation and Water Supply, by Leslie A. Miller. (PO) This paper stresses the necessity of conserving water supplies and using water to the utmost advantage. The functions of various federal agencies overlap, with no guiding national policy. Recommendations are made for a uniform policy as to the financing of projects in relation to beneficiaries and local, state, and federal governments.

900. Water Resources and Power Studies, Task Force, Hoover Commission: Flood Control, by W. W. Horner. (PO) This paper reviews the number and cost of presently constructed and probable future flood-control projects. An estimated 5.8% of the cost of projects completed was paid by local beneficiaries and the remainder by federal taxpayers. Another flaw in the program is the nonuniform method of calculating benefits of projects.

901. Water Resources and Power Studies, Task Force, Hoover Commission: Improvements to Navigation, by Carey H. Brown. (PO) This paper concludes that many navigational improvements now under consideration or recommended are of dubious economic value. Development of economically sound projects could be implemented by making user charges adequate at least for maintaining and operating navigation systems.

902. Discussion of Proceedings Papers 241, 424, 458, 720. (AT) No closure to 241. W. J. Turnbull and O. B. Ray closure to 424. G. S. Anderson, and G. McFadden closure to 458. R. H. Williams, J. F. Redus on 720.

903. Discussion of Proceedings Papers 461, 462, 705, 706, 708, 728, 788. (IR) H. M. Ismail closure to 461. No closure to 462. H. E. Thomas, C. E. Busby, P. H. Berg, J. C. Alexander on 705. H. E. Thomas, F. B. Clendenen on 706. Correction to 708. D. C. Muckel, C. C. Warnick, N. Szalay, C. W. Lauritzen on 728. W. M. Borland and C. R. Miller, and S. Leliavsky on 788.

904. Discussion of Proceedings Papers 696, 697, 700, 737, 739, 741, 742. (PO) M. D. Copen, A. W. Simonds, J. T. Richardson, A. C. Xerez on 696. R. F. Krafft on 697. J. L. Serafim on 700. G. B. Woodruff, J. Feld, W. W. Moore, G. L. Jordy on 737. R. N. Brudenell on 739. E. W. Vaughan, S. N. Nicolaou, W. R. Martin, Jr., and J. A. Veltrop, and M. L. Pei on 741. A. Hrennikoff, J. L. Serafim, S. Leliavksy on 742.

905. Discussion of Proceedings Papers 591, 685, 687. (SA) No closure to 591. T. R. Camp closure to 685. J. E. McKee on 687.

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SPECTACULAR ROOF DESIGN—
St. Louis Air Terminal Building

Airport Terminal Building, St. Louis, Mo. Architects: Hellmuth, Yamasaki & Leinweber; Structural Engineer: William C. E. Becker; Consultants on Dome Design: Roberts and Schaefer of Chicago; Chief Engineer City of St. Louis: W. R. Crecelius; General Contractor: L. & R. Construction Co.; Design of Concrete Mix: Robert W. Hunt Co.; Pozzolith Ready-Mixed Concrete—used throughout—produced by Majestic Materials Corp. All of St. Louis, Missouri, except as noted.

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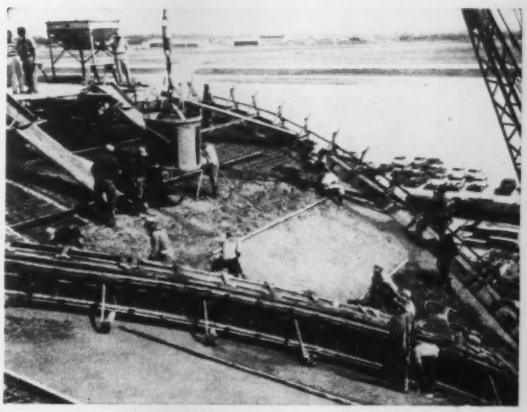

Upper View: Shows roof construction. *Lower View:* Shows placing and finishing concrete. Each dome contains about 400 cu. yds. of concrete and 60 tons of reinforcing steel, and was poured in one continuous operation.

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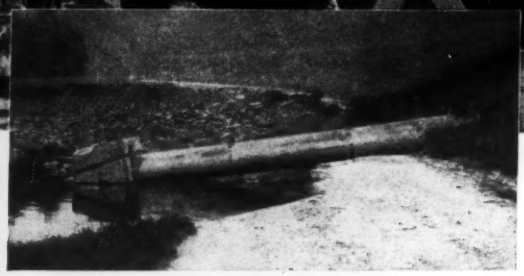

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